CIVIL ENGINEERING

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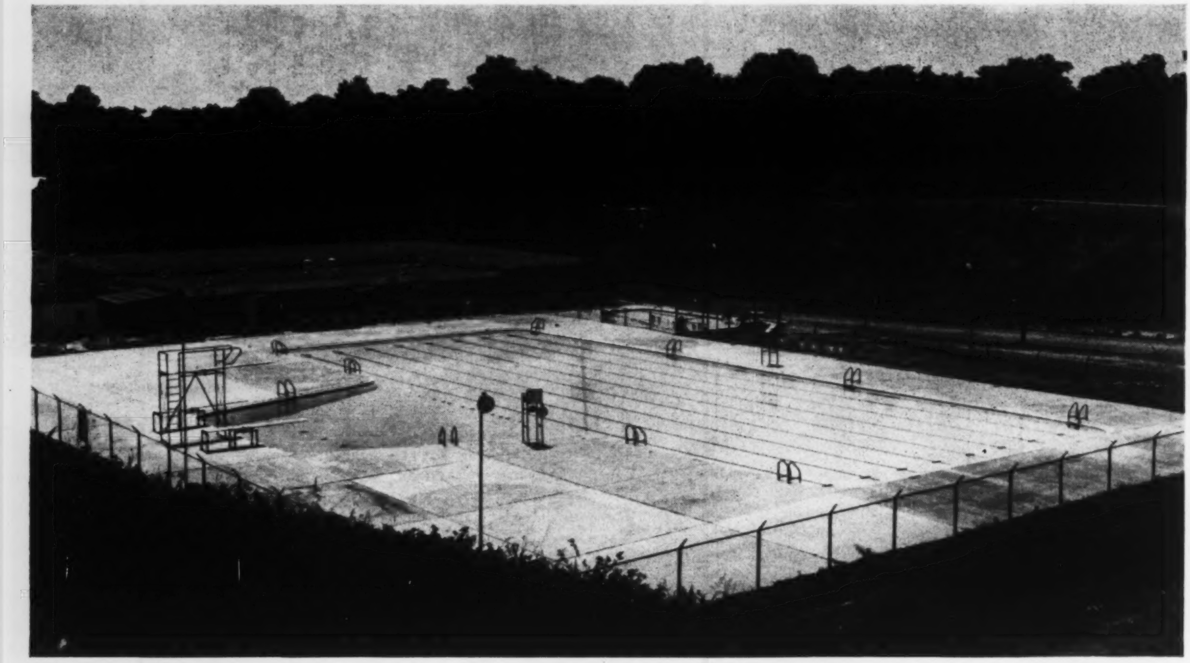
America's Finest Engineered Pool



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NATIONAL prestressed pool packages are available in all sizes from 16 x 32 up to any desired dimension for private and public pools. NATIONAL pools are approved by State Board of Health, and are designed to withstand forces caused by freezing in cold climates.

NATIONAL manufactures a complete line of superior equipment—underwater lights, vacuum cleaners, filters, etc. We retain a highly specialized engineering staff. Services of our staff are available, if desired, to all engineers and architects.

NATIONAL POOL EQUIPMENT CO.
Lee Highway, Florence, Alabama
Please send information on National Prestressed Pools

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I am interested in:
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- ☐ EQUIPMENT
- ☐ FILTERS
- ☐ HEATERS

NATIONAL
pool equipment co.
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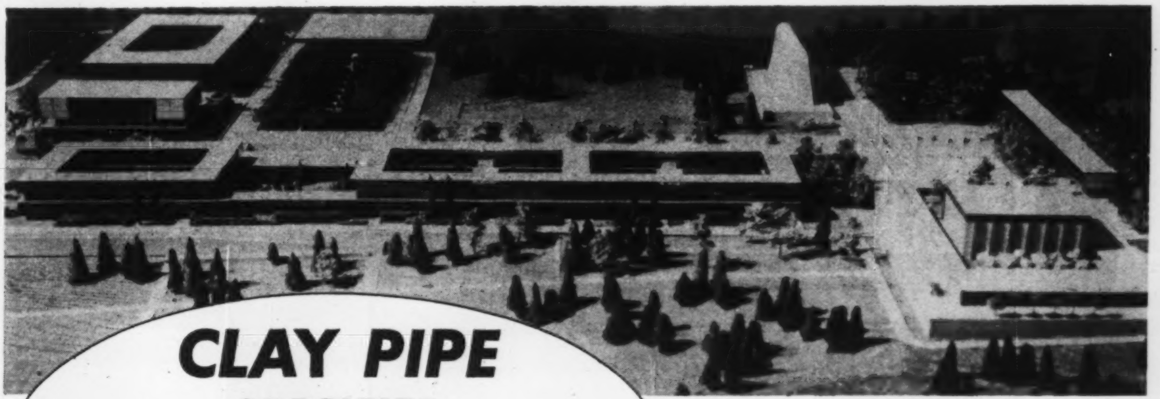

CLAY PIPE
SPECIFIED
for Sanitary Sewers in the New Air Force Academy

Architects-Engineers: Skidmore, Owings and Merrill.

Contractor: J. S. Brown-E. F. Olds Plumbing and Heating Corp., El Paso, Tex.

Job Manager: William Klaus.

Trenching: Smith-Nesbitt Co., Pueblo, Colo.

Pipe Installation: Moore Pipeline Construction Co., Lubbock, Tex.

COLORADO SPRINGS, COLO. The sanitary sewer installation at the new "West Point of the Air" calls for nearly 10 miles of pipe—and Vitrified Clay is in the specifications for the entire system.

When building for the future, quality and permanence are the top considerations. That's why large important projects call for Clay Pipe. When Vitrified Clay goes in, it is a well accepted fact the pipe will last. It is the only pipe that's absolutely safe against all forms of chemical deterioration. It does not rust; sewer gases do not corrode it; acids and alkalies do not soften it. And for final proof of quality, Clay Pipe is sold with a written guarantee—a vote of confidence matched by no other pipe manufacturers. The next time you plan and install new sewerage lines, specify Vitrified Clay. *It never wears out.*

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KNOWS
CLAY PIPE IS BEST

Vitrified
CLAY PIPE
CLAY PIPE NEVER WEARS OUT!

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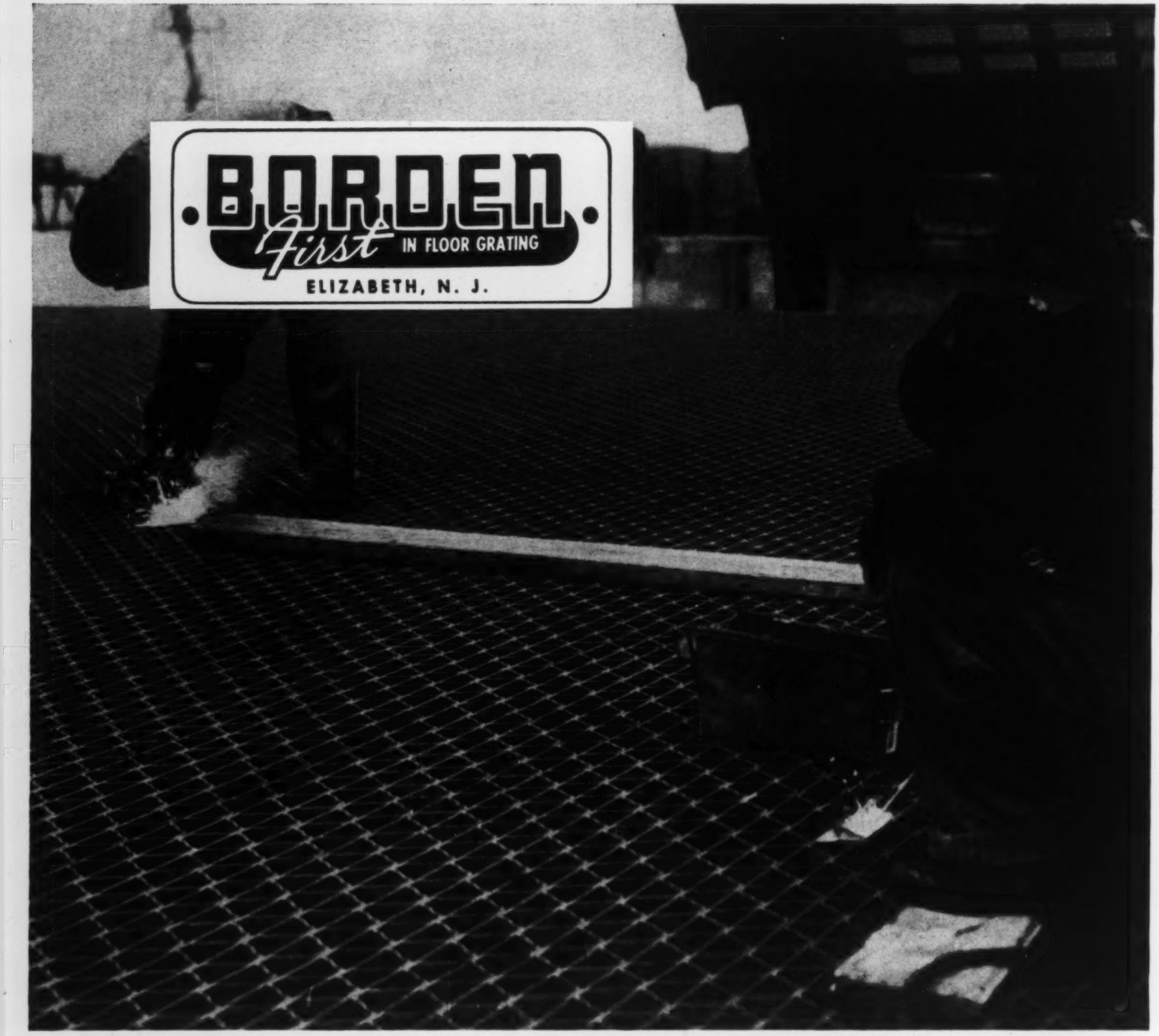

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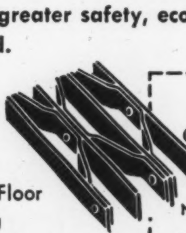

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CIVIL ENGINEERING

NOVEMBER 1957
VOL. 27 • NO. 11

THE MAGAZINE OF ENGINEERED CONSTRUCTION

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These TD-24 full-time let you run power circles

Exclusive, all-weather, seconds-fast International gasoline coversion starting. Direct combustion heat conditions the TD-24's engine, seconds-fast—for full diesel performance. You avoid the warm-up delays and service complications of a surplus starting engine —earn money while "slow starters" are warming up!

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Exclusive, years-proved Planet Power steering. Why put up with load limiting "dead track drag" on the turns in a king-sized steering clutch crawler? Why not profit from TD-24 Planet Power steering that enables you to pull or push as big a load on the turns as on the straight-away? See how TD-24 two-track turning power never backs off from a load. "Take the turn" to new profits with Planet Power steering!

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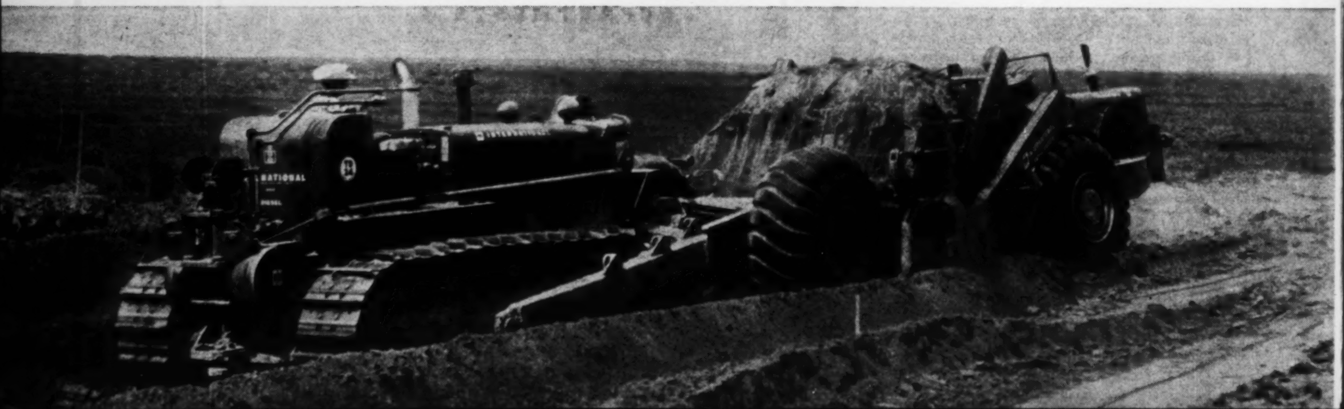
Exclusive TD-24 fingertip operating ease provides the operator comfort incentives and the means to give full days of full capacity cycle-speeding production!

Find out how these and all the other TD-24 production exclusives can equip you to run power circles around anything else on tracks. See your International Construction Equipment Distributor for a TD-24 demonstration!

Planet Power steering and Hi-Lo "power-crowd" keeps the TD-24 loading the "75" Payscraper® at top effective speed—adds up to increased daily yardage. Only 30 to 45 seconds needed to heap-load a "75" Payscraper—on this Dominic Leone Construction Co., Inc., Colorado road job!



production exclusives

around "cycle-stallers"

Even with such offset loads as a boulder-bucking angled blade—benching a road round a hill—TD-24 Planet Power steering lets you concentrate the power where you want it. You stay on course—production stays up!

On slam-bang rock-dozing or moving other heavy materials, instant TD-24 Hi-Lo shifting adjusts tractor power to load resistance—increases production, avoids delay! And you get fast reversing to speed shuttle-dozing!

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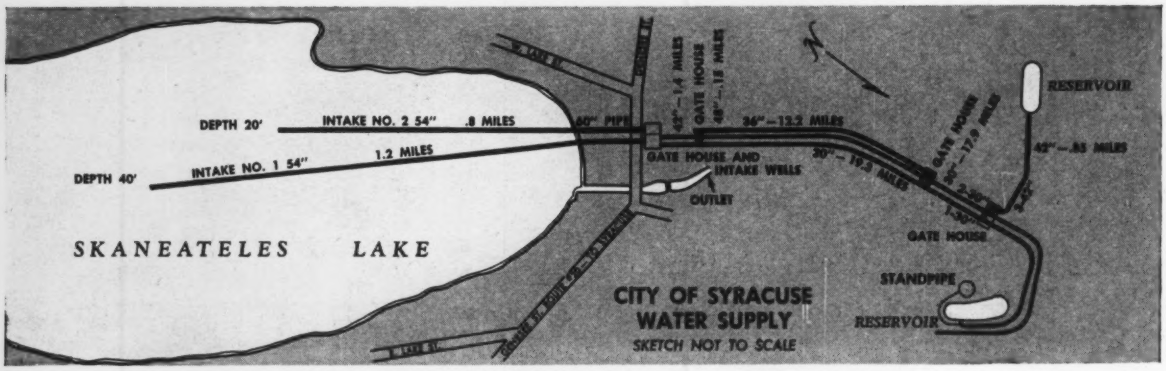
A COMPLETE POWER PACKAGE: Crawler and Wheel Tractors . . . Self-Propelled Scrapers . . . Crawler and Rubber-Tired Loaders . . . Off-Highway Haulers . . . Diesel and Carbureted Engines . . . Motor Trucks . . . Farm Tractors and Equipment.

Underwater intakes laid in '93 and '38 are in "excellent condition" today


DEPTH 20'
INTAKE NO. 2 54"
.8 MILES
DEPTH 40'
INTAKE NO. 1 54"
1.2 MILES
SKANEATELES LAKE
60" PIPE
42"—1.4 MILES
GATE HOUSE
48"—.15 MILES
36"—12.2 MILES
GATE HOUSE AND INTAKE WELLS
30"—19.3 MILES
OUTLET
GATE HOUSE
30"—17.9 MILES
RESERVOIR
42"—.85 MILES
2-30"
1-30"
GATE HOUSE
STANDPIPE
RESERVOIR
CITY OF SYRACUSE
WATER SUPPLY
SKETCH NOT TO SCALE

Sketch of Syracuse's water supply system. The lake source is about 20 miles from the city. Bethlehem has supplied thousands of feet of tar-enameled steel pipe used throughout the system.

This photograph was taken in 1938, when the City of Syracuse was installing its No. 2 water intake in Skaneateles Lake. Like No. 1, the newer intake consists of 54 in. ID x ⅜ in. steel pipe joined into sections on shore, floated to position, lowered to the lake bottom, and connected by divers. Intake No. 1 measures 6419 ft; No. 2 is 4213 ft long.

The 1938 intake pipe was supplied by Bethlehem in 30-ft lengths. It was coated and lined with modern spun coal-tar enamel, a big improvement over the asphalt coatings used on the older line which was installed back in 1893.

Here's what the City's Division of Water reports: "Inspections of the exterior of the intakes by divers indicate that both are in excellent condition today."

Similar reports from all parts of the country make it clear beyond doubt that tar-enameled steel pipe, properly installed, will give excellent service and long life under the very toughest conditions.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

Aerial views of Houston freeway

FOR FREEWAYS

Concrete Gives

Lower Annual Cost and Longer Life

Enormous increases in highway traffic by passenger cars and heavily loaded trucks have made the patterned mazes of today's freeways a transportation necessity.

America's most modern freeways use concrete—the road material which provides smooth uninterrupted travel regardless of the loads to be carried or the weather, at a lower annual cost. Here again, concrete serves the rapidly expanding needs of the nation with a construction material whose flexibility of use and durability have made it a "must" for good freeway construction.

Ideal Cement Company, Growing with the Country

PORTLAND IDEAL CEMENT

IDEAL CEMENT COMPANY

DENVER, COLORADO

14 Plants and 3 Terminals Serving
Some of the Most Rapidly Growing Areas of the Nation

Free and Easy Operation

with
BUILDERS
90°
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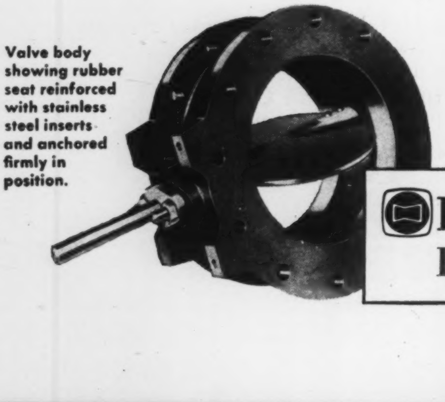
butterfly
valves!

In laboratory tests, a Builders Butterfly Valve was cycled *over a quarter million times,* and tested bubble-tight at 25 psi. This is equivalent to opening and closing a valve 12 times a day for over 55 years. Throughout this test, valve operation was easy at all times . . . no "freezing" whatsoever was experienced. There was no sign of leakage at the gland and wear on shaft and bearings was negligible.

- **90° SEATING—truly balanced valve requiring no operator torque to maintain closed position.**
- **Adjustable mechanical stops to accurately locate valve disc in open and closed positions.**
- **Valve seats of natural rubber reinforced with stainless steel securely bonded into the rubber. Seat cemented and secured for stress-free, rugged bonding to valve body.**
- **Adjustable two-way thrust bearings insure that valve disc is accurately centered.**

If water means money to you, your client, or your community, investigate bubble-tight AWWA Standard Builders Butterfly Valves . . . built by specialists in water and sewage works equipment for these particular services.

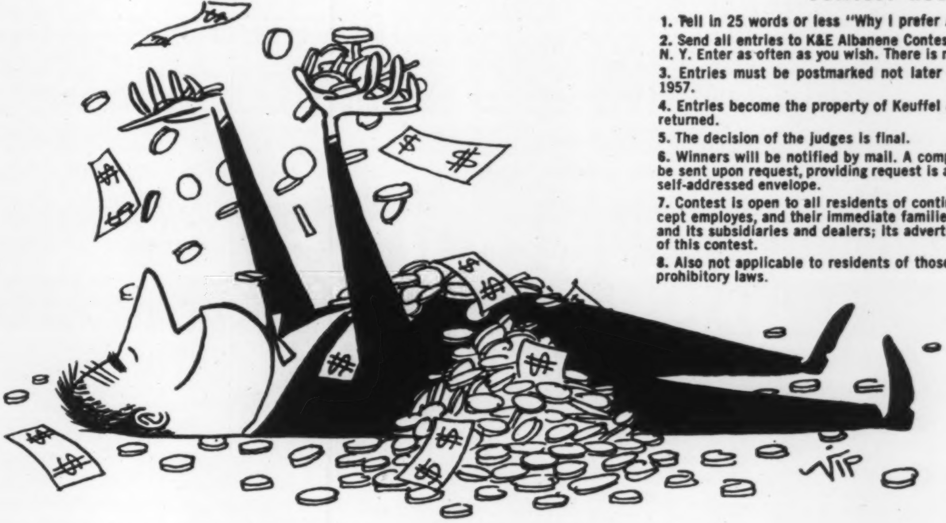


Valve body showing rubber seat reinforced with stainless steel inserts and anchored firmly in position.

Request Bulletin 650-L1B which fully describes these and other design features. **Builders-Providence, Inc., 360 Harris Avenue, Providence 1, Rhode Island.**

BUILDERS-PROVIDENCE
DIVISION OF
B-I-F INDUSTRIES METERS FEEDERS CONTROLS

ENTER THIS CONTEST ...90 CASH PRIZES!



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2. Send all entries to K&E Albanene Contest, Box 160, New York 46, N. Y. Enter as often as you wish. There is nothing to buy.
3. Entries must be postmarked not later than midnight, Nov. 30, 1957.
4. Entries become the property of Keuffel & Esser Co. None can be returned.
5. The decision of the judges is final.
6. Winners will be notified by mail. A complete list of winners will be sent upon request, providing request is accompanied by stamped, self-addressed envelope.
7. Contest is open to all residents of continental United States, except employes, and their immediate families, of Keuffel & Esser Co. and its subsidiaries and dealers; its advertising agency; and judges of this contest.
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plus 87 prizes of $25 each!

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Or use a plain sheet of paper if someone's already snipped the blank below. Give your name, address, and firm name, twenty-five words or less telling why you prefer Albanene tracing paper, and mail to K&E Albanene Contest, Box 160, New York 46, N. Y. before midnight, November 30, 1957.

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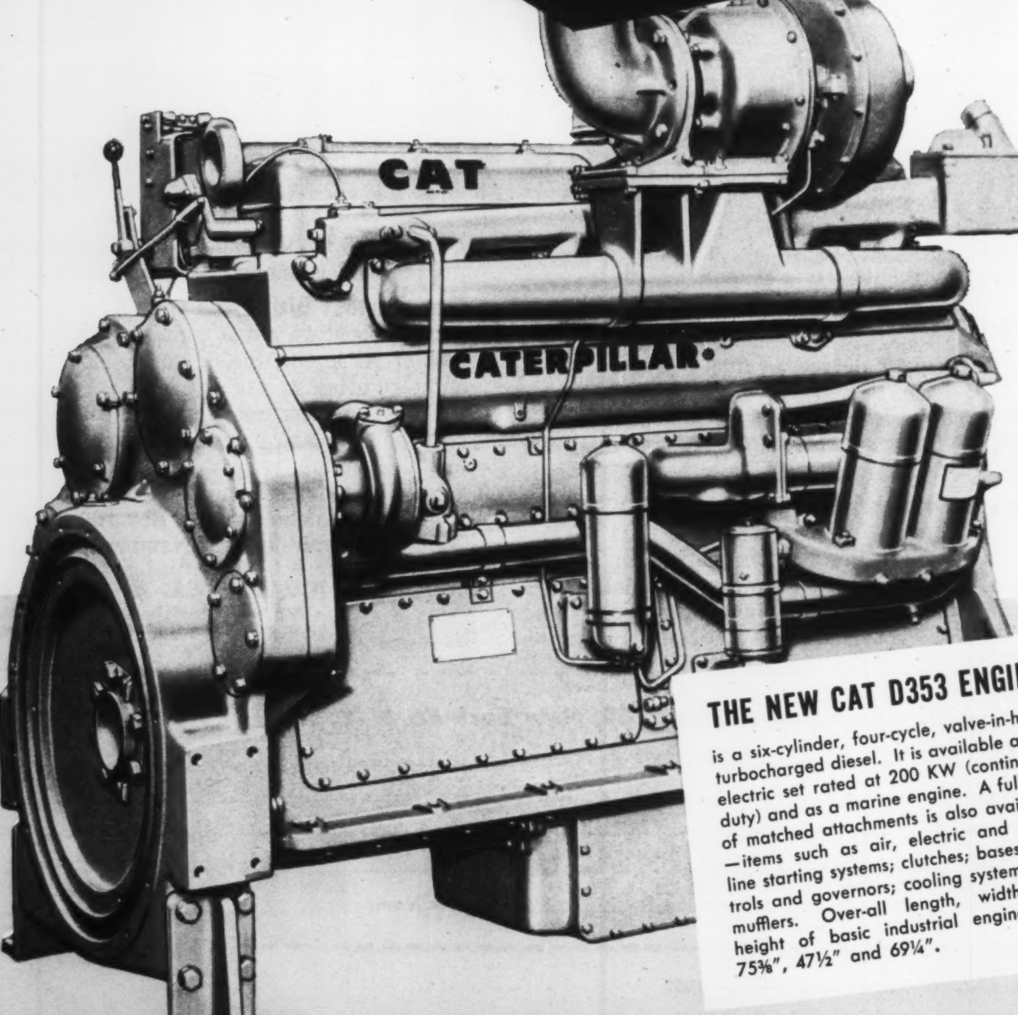
Caterpillar announces in the world's most

The engine that delivered outstanding is now available as the D353 Industrial

D397	D375	New D353	D342	D339
650 HP†	430 HP†	390 HP†	225 HP†	140 HP†



THE NEW CAT D353 ENGINE

is a six-cylinder, four-cycle, valve-in-head turbocharged diesel. It is available as an electric set rated at 200 KW (continuous duty) and as a marine engine. A full line of matched attachments is also available —items such as air, electric and gasoline starting systems; clutches; bases; controls and governors; cooling systems and mufflers. Over-all length, width and height of basic industrial engine are: 75⅜", 47½" and 69¼".

another heavy-duty engine advanced line of diesels

performance in the famous D9 Tractor Engine, Electric Set and Marine Engine

D337	D326	D318 (SERIES G)	D315 (SERIES G)	D318	D315	D311
310 HP†	200 HP†	175 HP†	115 HP†	137 HP†	91 HP†	65 HP†

†Maximum output capacity

Adding to Caterpillar's line of modern heavy-duty engines, there's now the Turbocharged D353 rated at 390 HP (maximum output capacity). This engine, a prototype of the unit in the mighty D9 Tractor, is job-proved after thousands of hours of operation in the field!

Like all modern CAT* Diesels, the D353 incorporates in its design the advanced features developed by Caterpillar in a quarter century of diesel leadership. Compact and sturdy, it is built for the hard work. Its four-cycle design delivers the long, effective power stroke that puts power to more efficient use than other types of engines. Its turbocharger utilizes waste energy from the engine exhaust to increase over-all efficiency and economy. Its fuel system requires no adjustment. There are no cylinder ports to clean. And its exclusive Caterpillar single-orifice injection valves, combined with the precombustion chambers, permit the use of a wide range of fuels including premium diesel fuels as well as low-cost No. 2 furnace oil *without fouling*. All these and other features add up to performance that no unit in its power class can match.

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For complete information about the new D353 and other Cat Diesels, see your Caterpillar Dealer. Let him show you how diesel leadership based on a quarter century of experience can engineer the modern, heavy-duty diesels of tomorrow.

Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

CATERPILLAR*

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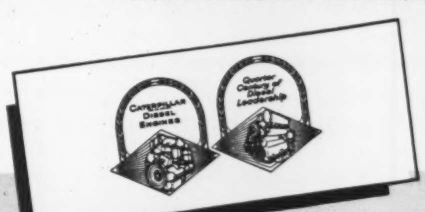
Caterpillar Diesel Engines
Quarter Century of Diesel Leadership

Caterpillar "Firsts" in a Quarter Century of Diesel Leadership

- "Hi-Electro" hardened cylinder liners
- Chemically conditioned cylinder liners
- Stainless-steel piston protectors
- Aluminum alloy bearings
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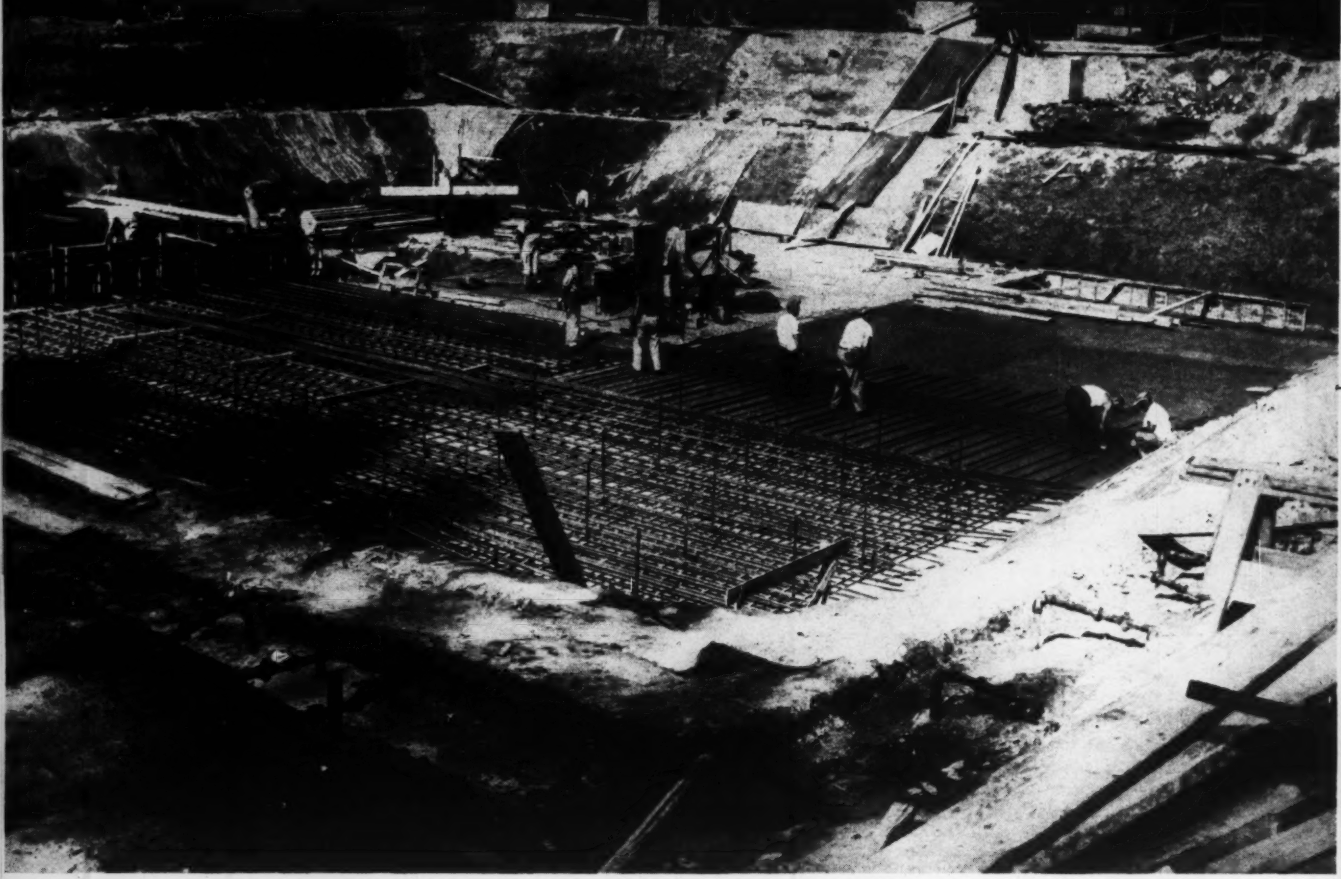
- Capsule-type injection valves
- Service meters
- Superior lubricants (detergent oils)
- Notarized, certified power

AND MANY MORE!

Certified Power for Cat Diesel Engines

Through the years, Caterpillar Engines have earned a reputation for *honestly rated power*. Now Caterpillar backs this reputation with a *notarized certificate* covering the horsepower capabilities of each engine. Caterpillar is the first and only manufacturer to give you this assurance of capacity. You have a right to demand *certified power* when you invest in an engine. You get it when you buy from your Caterpillar Dealer!

IBM FOUNDATION STARTS EFFICIENTLY IN THE DRY . . .



General Contractor: A. E. Stephens Co., Springfield, Mass.
Pumping Contractor: American Dewatering Corporation, New York
Consulting Engineers: Moran, Proctor, Mueser & Rutledge, New York

A MORETRENCH WELLPOINT SYSTEM controls 12′ of water in varved layers of silt and clay while the contractor constructs foundation for International Business Machine Corp's. new office building in Hartford, Connecticut.

Pumping started at 4:30 PM on June 19th. On June 22nd they were excavating in the dry.

The cost of efficient pumping is *lower* than you think. On your next wet job, find out in how many ways Moretrench Wellpoint Equipment can save you money. Our nearest office is at your service.

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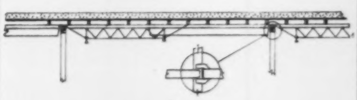
Spanall
HORIZONTAL SHORING
FOR ALL BEAM AND SLAB CONCRETE FLOOR FORMS
SPANALL OF THE AMERICAS, INC.
Spanall of Canada, Ltd.

Page 6. Spanall installs fast and easy.



Page 5. Spanall applies to any type of poured concrete construction.

Page 7. Plywood decking laid directly on Spanall.

Newest Catalog features new way to save time, cut costs

Here is practical, profitable information about Spanall, the popular, new, all-metal Horizontal Shoring for concrete forms. Photos, charts and drawings clearly illustrate how Spanall is erected, stripped and stored—with new ease and speed... how Spanall adjusts quickly to any required span length—how Spanall forever eliminates cumbersome, costly vertical shoring... and actually saves as much as 40% in both time and money.

Get *all* the facts about Spanall—it could provide just the competitive advantage you'll need for 1957.

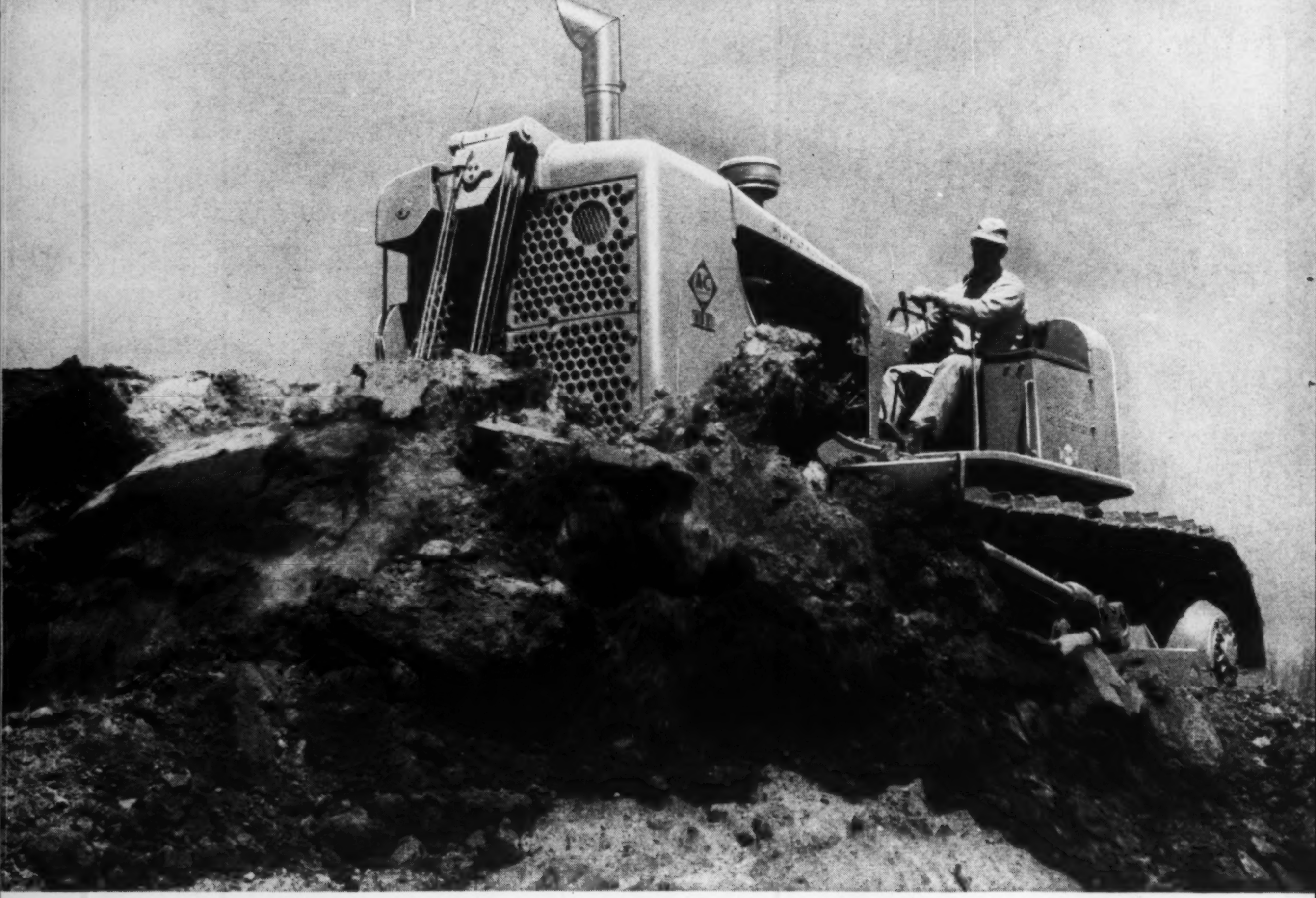
Page 2. Spanall replaces vertical shoring, frees work areas below forms.

SPANALL OF THE AMERICAS, INC.
787 United Nations Plaza, New York 17, N. Y.
Gentlemen—Please send, without cost or obligation, ______ copies of the new Spanall Catalog.

NAME ______ POSITION ______
FIRM ______
ADDRESS ______
CITY ______ STATE ______

HERE'S THE NEW HD-21...

Designed and Built to Fit Today's Big-Tractor Jobs



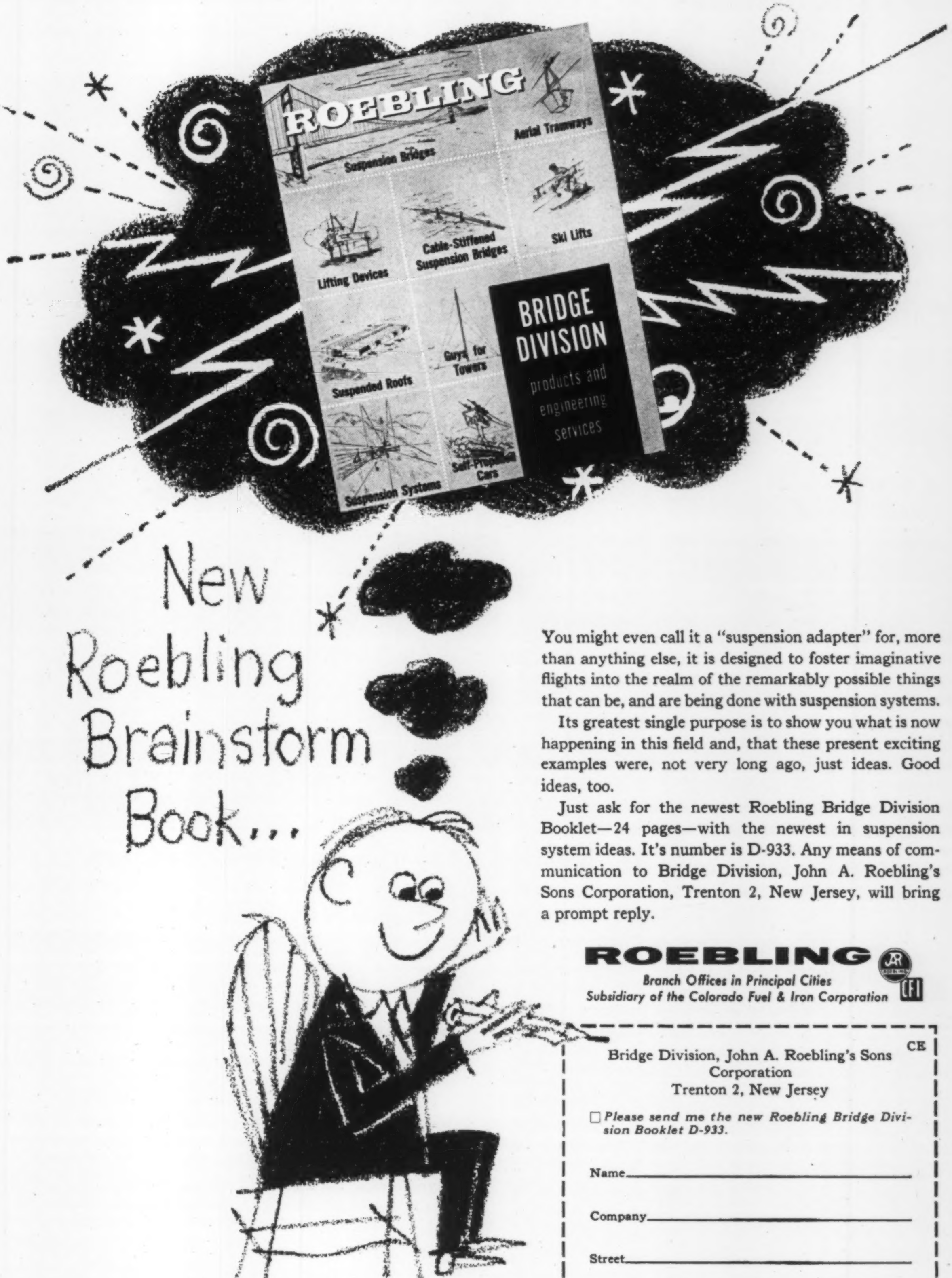
NEW HD-21 IN ACTION with new 15-ft. angle-dozer; approximate total weight, 56,225 lb.

Now . . . major advances make the Allis-Chalmers HD-21 more productive than ever . . . capable of handling big-tractor jobs of every kind with the efficiency and dependability all contractors want and need.

New 225-net-hp turbo-engine
New weight—45,500 lbs (bare)
New power train and torque converter effectiveness and simplicity
New longer track for matched traction, flotation
New operating ease and control with work-saving decelerator
New heavy-duty matched dozers

Here's a big tractor you can depend on to help you bid with confidence in your cost estimates. Your Allis-Chalmers dealer will be glad to talk to you about the new "21" . . . and to prove its value in a working demonstration on your job. Allis-Chalmers, Construction Machinery Division, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS *Engineering in Action*


ROEBLING
Suspension Bridges
Aerial Tramways
Lifting Devices
Cable-Stiffened Suspension Bridges
Ski Lifts
Suspended Roofs
Guys for Towers
Suspension Systems
Self-Propelled Cars
BRIDGE DIVISION
products and engineering services

New Roebling Brainstorm Book...

You might even call it a "suspension adapter" for, more than anything else, it is designed to foster imaginative flights into the realm of the remarkably possible things that can be, and are being done with suspension systems.

Its greatest single purpose is to show you what is now happening in this field and, that these present exciting examples were, not very long ago, just ideas. Good ideas, too.

Just ask for the newest Roebling Bridge Division Booklet—24 pages—with the newest in suspension system ideas. It's number is D-933. Any means of communication to Bridge Division, John A. Roebling's Sons Corporation, Trenton 2, New Jersey, will bring a prompt reply.

ROEBLING
Branch Offices in Principal Cities
Subsidiary of the Colorado Fuel & Iron Corporation

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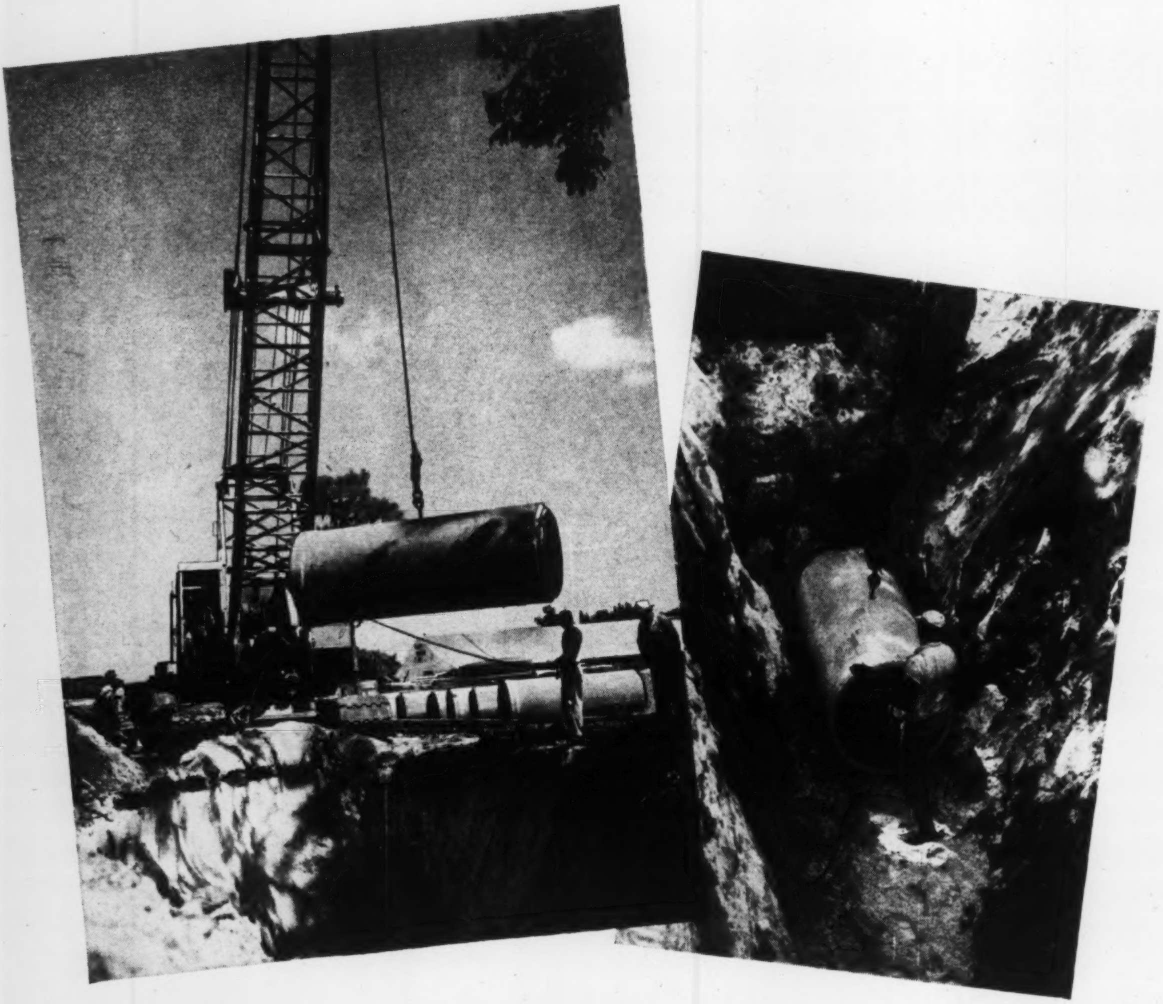

St. Petersburg, Florida, extends its sewer system with reinforced CONCRETE PIPE

St. Petersburg is engaged in the most comprehensive sanitary sewer construction program in its history. An initial $14,000,000 project will extend service from 8.4 to 50 sq. miles within the city limits. Further expansion is planned in the future as population, commercial development and tourist business increase.

The program includes many miles of concrete trunk lines and laterals, four treatment plants and 15 lift stations as well as major manhole installations and related facilities.

In some sections concrete pipe was laid in deep trenches in porous sands and mucky soils. Some of the cuts averaged 16 to 25 ft. in depth in areas where excavation would have been almost impossible without using wellpoints and pumps.

Like St. Petersburg, hundreds of cities have ***low-annual-cost*** concrete pipe sewer service. Some cities have had economical concrete pipe sewer service for 75 to 100 years and more.

Concrete pipe has a long, successful record of solving difficult sewer problems because it offers (1) the strength to resist severe impact and to sustain heavy overburdens, (2) maximum hydraulic capacity and resistance to abrasion due to smooth interior surface and even joints and (3) tight joints and uniformly dense structure to insure minimum infiltration and leakage.

Concrete pipe sewers are moderate in first cost, need little or no maintenance and serve for years. They deliver ***low-annual-cost*** service, which benefits civic officials as well as the taxpayers.

PORTLAND CEMENT ASSOCIATION **33 West Grand Avenue, Chicago 10, Illinois**

A national organization to improve and extend the uses of portland cement and concrete . . . through scientific research and engineering field work

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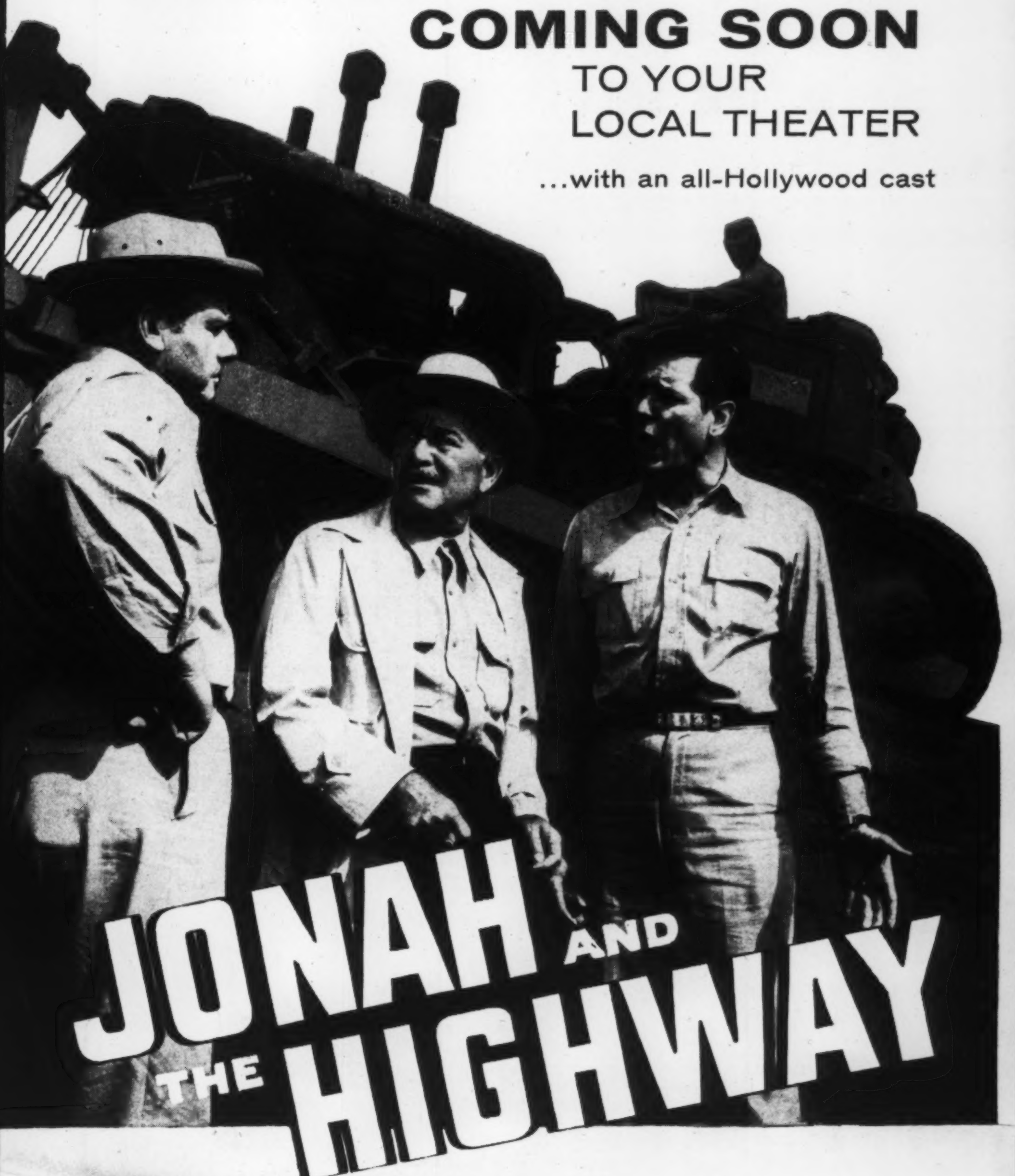
TO YOUR
LOCAL THEATER

...with an all-Hollywood cast



JONAH AND THE HIGHWAY

the show that's on the road

to tell everyone about
the suspense and excitement
the challenges and triumphs

**THAT ARE EVERY-DAY OCCURRENCES
TO THE MODERN HIGHWAY
ENGINEER AND CONTRACTOR**

**KEEP OUR
ROADS
ON THE GO**

Craig **STEVENS**

as Bill White, who had worked on two jobs that had gone bad and now felt that he was a "Jonah" to the highway-building business.

Lola **ALBRIGHT**

as Mary, Bill's wife, who thought he was the finest engineer ever graduated, but wanted Bill to think so too.

Robert **ARMSTRONG**

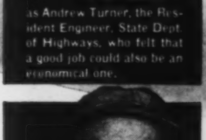
as Jack Thompson, the contractor who didn't like to have unlucky guys on the job, but who also felt every man needed a chance to prove himself.

Hal **STALMASTER**

as Jimmy Carter, the 17-year-old who was looking for engineering experience, but who didn't expect to be an "ax man" on his first job.

Alan **HALE**

as Andrew Turner, the Resident Engineer, State Dept. of Highways, who felt that a good job could also be an economical one.



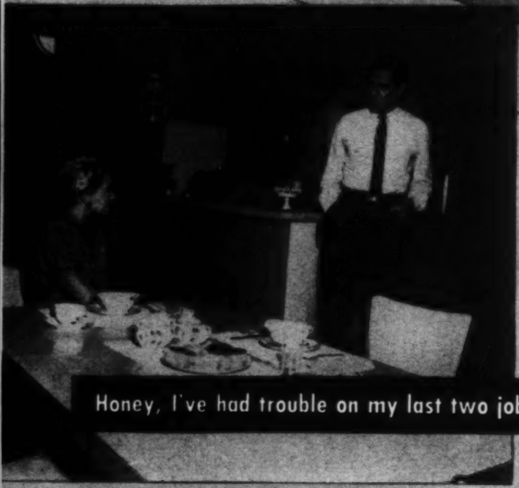
Robert **FOULK**

as Mike Bentley, the foreman, who wasn't as gruff as he first sounded.

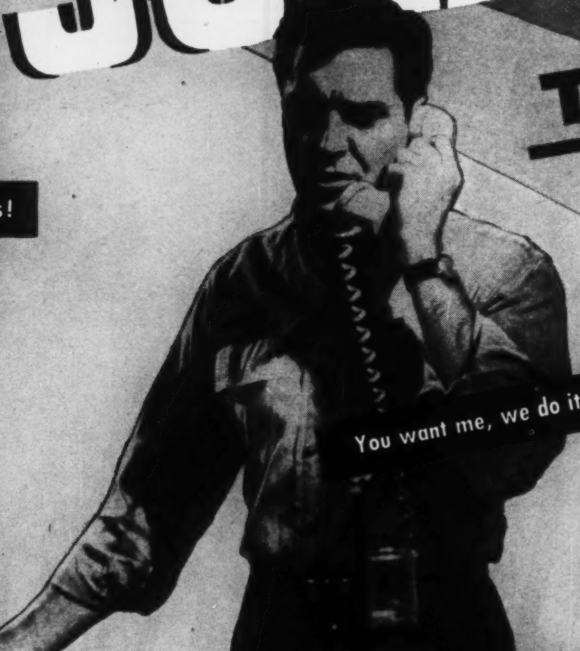
SELECTED MOMENTS OF DECISION, AND OF ULTIMATE TRIUMPH

JONAH

THE



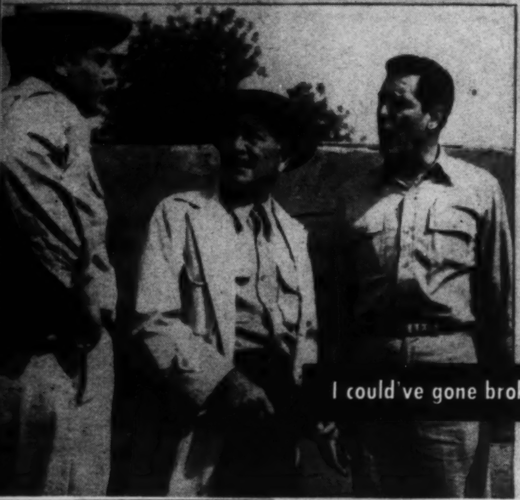
Honey, I've had trouble on my last two jobs!



You want me, we do it my way.

I hire engineers . . .
not alibi artists.

It's a tough break, Bill.



I could've gone broke.

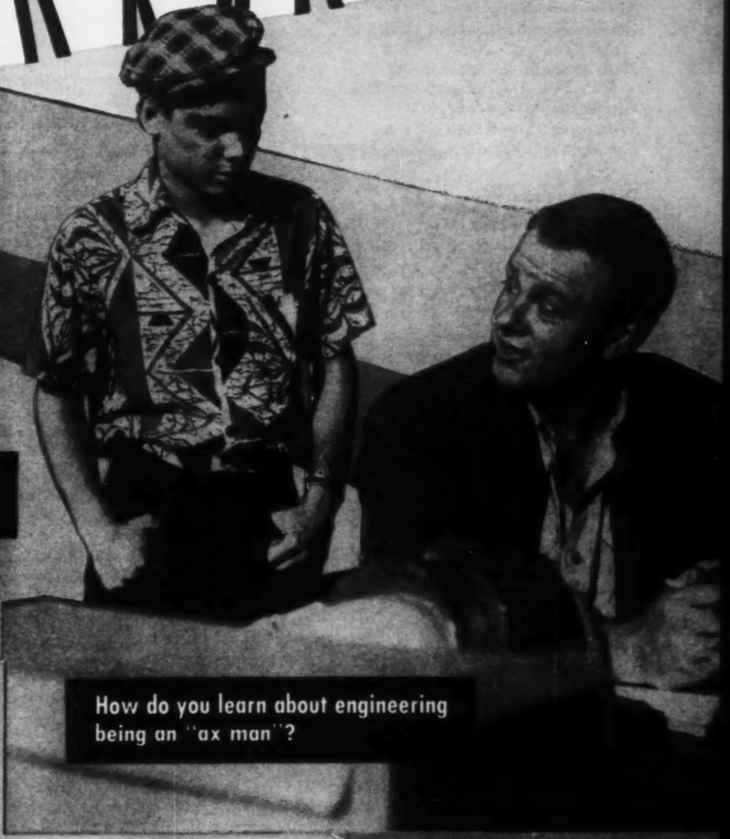
OF THREATENING DANGER

as seen in

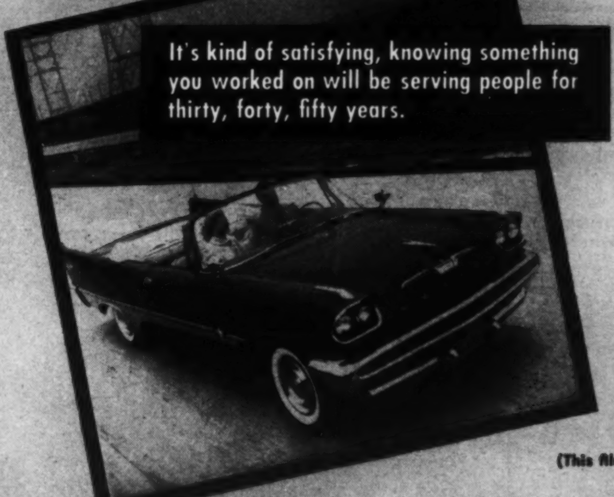
AND

HIGHWAY

Let's try that trick we used against the Japs on the Ledo Road.



How do you learn about engineering being an "ax man"?



It's kind of satisfying, knowing something you worked on will be serving people for thirty, forty, fifty years.

USS

Produced by United States Steel in the interest of highway engineers and contractors and the Federal Highway Program.

JONAH AND THE HIGHWAY

is coming soon to your local theater.
Be sure to see it!

KEEP OUR ROADS ON THE GO

(This film will be available for private group showings, but not before September, 1958)

Only United States Steel can offer you such a complete line of products for Highway Construction

KEEP OUR ROADS ON THE GO

Special Steels for Construction Equipment

- Abrasion-resisting steel
- Constructional alloy steel, *Carilloy* and *"T-1"*
- High strength, low alloy steels, *Man-Ten, Tri-Ten* and *Cor-Ten*
- Grader blades, *AmBridge*
- Wire rope, *Tiger Brand*
- Tubing, seamless mechanical, *Shelby*

Drainage Products

- Sectional plate pipe arches, *AmBridge*
- Culvert sheets, corrugated steel
- Culvert pipe
- Culvert pipe, perforated
- Road flume, *Ro-Drain*

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- Bearing piles, tubular steel, *National*
- Sheet piling, steel
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- Bridge flooring, concrete-filled grid, *AmBridge I-Beam-Lok*
- Bridge flooring, open grid, *AmBridge I-Beam-Lok*
- Bridge sidewalk flooring, T-grid, *AmBridge I-Beam-Lok*
- Bridge railing, *National*
- Grating, expanded metal
- Expansion joints
- Bridge nuts, pins and tie-rods
- Rivets
- Eye-bars
- Bolts, high strength steel
- Rivet bolts, high strength steel
- Creosote—for pressure treating bridge flooring and wood piling

Pavement Construction Products

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- Portland slag cements, *Universal*
- Air-entraining portland cements, *Atlas Duraplastic*
- Air-entraining portland slag cements, *Universal*
- High-early portland cements, *Atlas*
- White cements, *Atlas*
- Concrete reinforcing bars, straight and bent, *Di-Lok*
- Alloy steel reinforcing bars, *Carilloy*
- Welded wire fabric for reinforcing concrete, *American*
- Stress-relieved strand and wire for prestressed concrete, *Super-Tens*
- Concrete forms
- Concrete form insulation
- Road-joint assemblies, *American*
- Air-cooled blast furnace slag, crushed and screened
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- Granulated blast furnace slag

Safety Equipment and Highway Accessories

- Beam guard rail, *AmBridge* and *American*
- Multisafty Cable Highway Guard, *American*
- Highway guard rail, *Western*
- Highway guard rail posts
- Double-duty traffic markers
- Pipe for radiant heating and snow melting installations, *National*
- Electrical wire and cable, *Tiger Brand*
- Conduit, rigid steel, *National*
- Woven wire fence, *American*
- Chain link fence, *Cyclone*
- Barbed wire, *American*
- Fence gates, *American*
- Fence posts, *American*
- Fence staples, *American*
- Fence tools, *American*
- Creosote—for pressure treating wood fence posts
- Building construction service
- Steel for buildings, maintenance, utility, temporary offices
- Joists, open-web steel, *AmBridge*
- Sheet steel, corrugated
- Sheet steel, galvanized
- Nails, *American*
- Pipe, black and galvanized, *National*

The products and services indicated above are available from one or more of the United States Steel Divisions. USS offices are located in almost all major cities. Feel free to call on the office nearest you at any time—or write to:

UNITED STATES STEEL
525 William Penn Place, Room 5675
Pittsburgh 30, Pennsylvania

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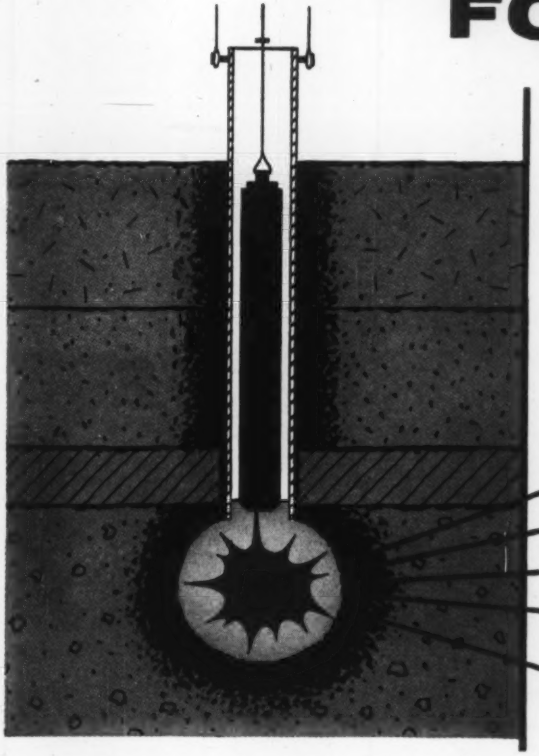


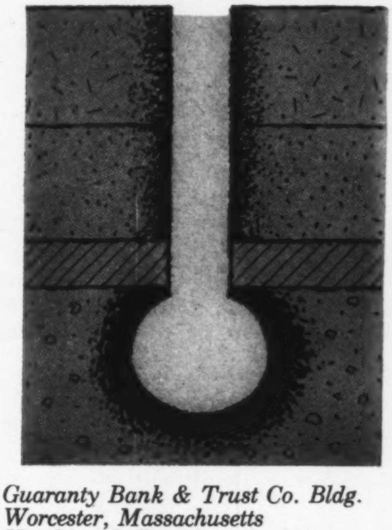
UNIQUE INSTALLATION METHOD CREATES PRESSURE INJECTED FOOTINGS!

compare these advantages with ordinary concrete footings:

- **ZERO SLUMP, "POUNDED IN"** concrete
- **FORGED** by 150,000 FT. LB. blows
- **EXPANDED BASES**—36" to 60" diameter
- **BEARING IN DEPTH** in granular soil or on rock
- **GUARANTEED** to support specified design loads

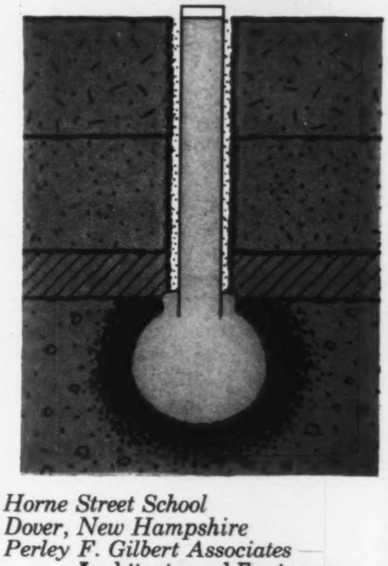
After completion of the pressure injected footing, these two options are available:

UNcased Shaft



Guaranty Bank & Trust Co. Bldg.
Worcester, Massachusetts
Hutchins & French — Architect
Frank H. Whelan & Co. — Engineer
J. B. Lowell, Inc. — General Contr.

Cased Shaft



Horne Street School
Dover, New Hampshire
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For brochure describing Franki Foundation methods, write to:

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UNIVERSAL PRODUCTS

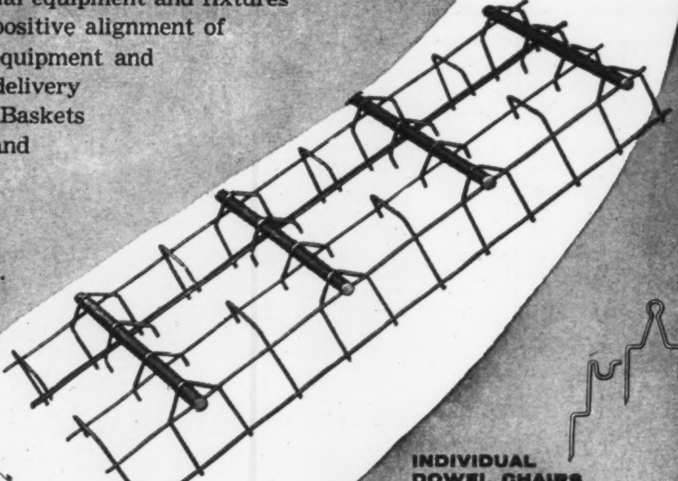
for highway construction

DOWEL BASKET ASSEMBLIES

Universal Dowel Basket Assemblies are designed and fabricated to specifications. Special equipment and fixtures guarantee accurate spacing and positive alignment of dowels. High speed production equipment and modern facilities insure prompt delivery of your requirements. Universal Baskets are approved by Federal, State and private authorities for highway and airport construction.

Let us quote on your requirements. Write for complete details today.

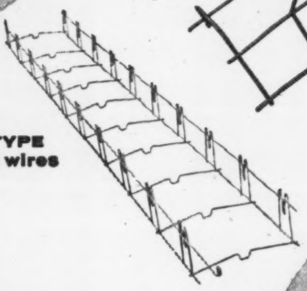
HEAVY DUTY TYP
Maximum strength and support



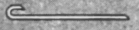
INDIVIDUAL DOWEL CHAIRS

Two-legged dowel chair holds dowel in 2 positions. Easily pushed into subgrade — won't turn after installation. Wide range of heights.

Single Leg Dowel Chair permits quick snap-in of Dowel. Sizes to support Dowel from 3" to 6" above sub-grade.

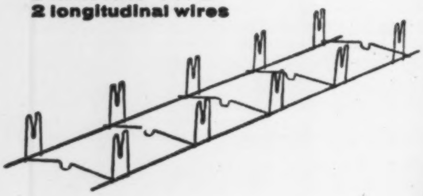


STANDARD TYPE
4 longitudinal wires

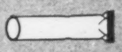


STAKE PINS

Keep Dowel Bar Assemblies in place during the pour. Lengths from 4" to 15" in ¼" increments.

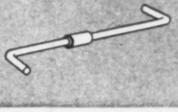


STANDARD TYPE
2 longitudinal wires



DOWEL SLEEVES

Metal Dowel Sleeves for covering ¾" Dowel Bars; overall length covers 2½" or 3" Dowel. Special sizes and lengths available.



HOOK BOLT ASSEMBLY

For providing required tieing element along longitudinal joint. Eliminates necessity of bending tie bars or drilling road forms.

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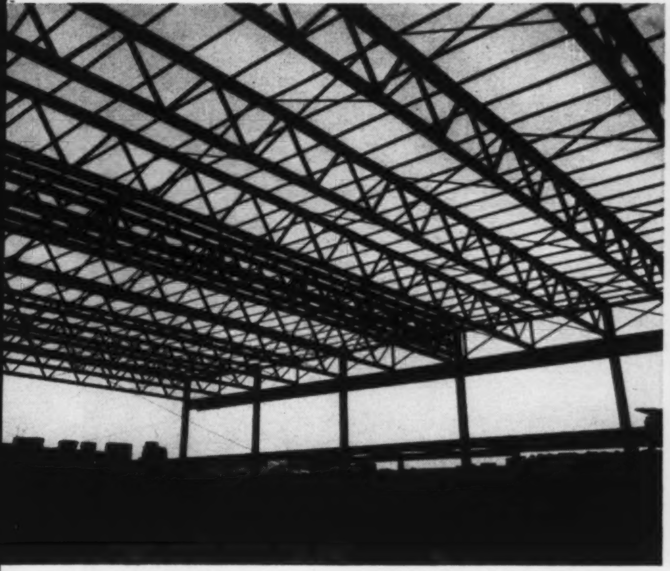

AMBRIDGE STEEL JOISTS

speed construction of another modern school

THE MODERN ONE- AND TWO-STORY SCHOOL BUILDING shown above is a good example of the use of open-web steel joists in construction of this type. Used for the roof, ceiling and floor supports of the 430′ x 346′ irregularly shaped steel-frame building, the USS AmBridge Steel Joists not only contribute to its structural soundness and fireproofing, but in the gym and auditorium they provide the strength needed to carry the weight of the roof across exceptionally wide columnless floor areas.

American Bridge was contractor for the steelwork on this project. In addition to fabricating and erecting 127 tons of USS AmBridge Standard and Longspan Steel Joists with bridging, we also fabricated and erected 100 tons of structural steel for the framework of the long, wide building.

USS AmBridge Steel Joists provide rigid, lightweight and economical construction suitable for any type of floor, roof and ceiling. Their design permits maximum headroom and allows for passage of pipes, ducts and conduits in any direction. In floor construction, the ease and simplicity of handling reduces installation time to a minimum and permits other trades to begin their work promptly. For roof construction, these same advantages cut the time required to put your structure under cover.

For detailed information about the time- and money-saving advantages of using USS AmBridge Steel Joists on your next job, contact the nearest Contracting Office, or write direct to Pittsburgh for a free copy of our 40-page catalog.

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AMBRIDGE STEEL JOISTS

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UNITED STATES STEEL

COAST TO COAST...

Daytona Beach, Fla.—16" flexible joint cast iron pipe being installed for water line crossing Halifax River.

Across the nation, thousands of forward-looking communities use cast iron pipe for their water, gas and sewerage systems. For good reason! Nearly seventy American cities are still being served by cast iron mains laid over a century ago. This outstanding record for long life is unmatched by any other pipe!

What's more, the *modernized* cast iron pipe, centrifugally cast, today is even stronger, longer-lasting, more uniform.

When mains are needed, specify cast iron pipe. It's America's foremost pipe . . . for performance, dependability, economy. The record proves it!

CAST IRON PIPE

IT'S CAST IRON PIPE

Cleveland, Ohio—Over one half million gallons of sludge are pumped daily through 13 miles of 12" cast iron force main to the Southerly Sewage Treatment Works.

Portuguese Bend, Calif.—Cast iron pipe and fittings for salt water line at Oceanarium, Marineland of the Pacific.

CAST IRON

Cast Iron Pipe Research Association, Thos. F. Wolfe, Managing Director, Suite 3440, Prudential Plaza, Chicago 1, Ill.

SERVES FOR CENTURIES...

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Someone is going to get taken for a ride

A Materials Interchange Plan can make it happen sooner—and make it a happy one . . . with 65 million cars on the highway—20 million more in 10 years—someone is getting taken for a ride . . . every minute of every day. Let's make it a happy ride. Current highway construction programs can do it. A *Materials Interchange* design and specification plan that includes Asphalt can help grandma get taken for a pleasant ride sooner.

Here's what at least one Midwest state is doing about it: Highway authorities have drawn plans for alternate types of construction. Materials available at the time of construction will be used. No time is lost in this construction program. No experienced engineering manpower is lost rewriting specs and redesigning projects.

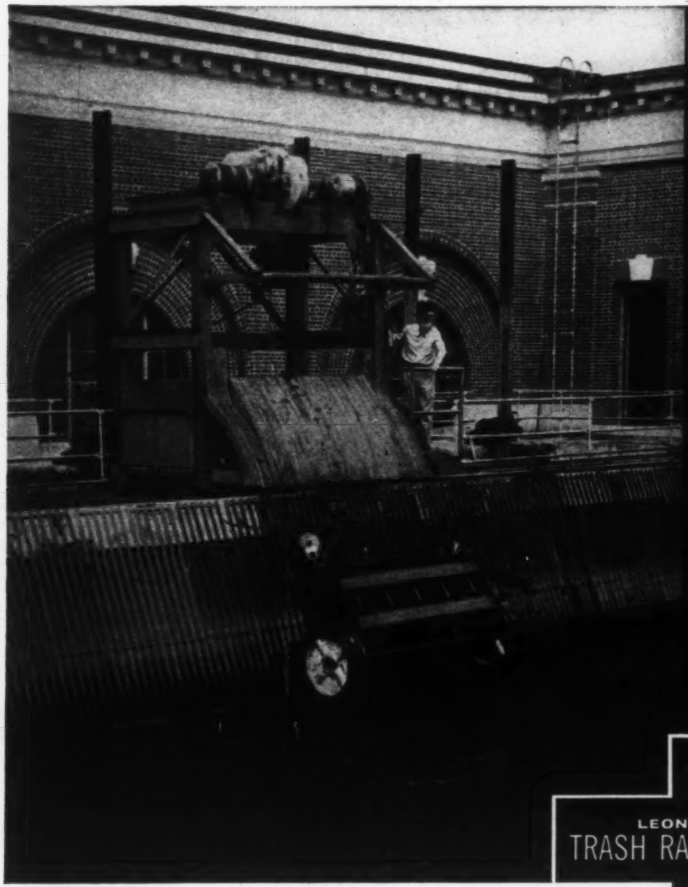
Make this your plan. Employ *Materials Interchangeability* so that roads under your authority may be built from materials available at time of construction. Include Asphalt in your construction planning.

Remember these facts: Standard Oil produces Asphalt at four convenient Midwest locations. Tank car and tank truck deliveries are made to you from the Standard Oil refinery nearest your job. Technical Service on Asphalt for highway construction is provided by Asphalt construction specialists who work out of 23 Standard Oil offices all over the 15 Midwest and Rocky Mountain states. Standard Oil has a record of taking care of its customers demonstrated by its delivery on contracts in times of short supply as well as when materials are plentiful.

Get more facts about STANDARD Asphalt from the Standard Oil office nearest you. Or write Standard Oil Company, 910 South Michigan Avenue, Chicago 80, Illinois.

STANDARD

STANDARD OIL COMPANY
(Indiana)



New 8-foot, self-dumping SMS rake at Niagara Mohawk Power Corporation's Black River Station is one of five recently installed by this company.

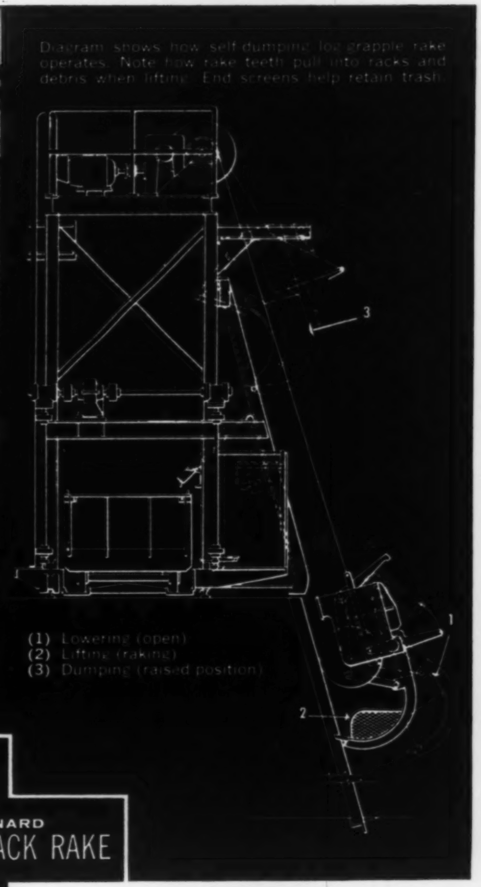


Diagram shows how self-dumping log-grapple rake operates. Note how rake teeth pull into racks and debris when lifting. End screens help retain trash.

(1) Lowering (open)
(2) Lifting (raking)
(3) Dumping (raised position)

LEONARD
TRASH RACK RAKE

Two New Self-Dumping SMS Trash Rake Designs
CUT CLEANING TIME AND LABOR

Now SMS offers you two improved Leonard trash rack rakes, both regular and log-grapple types. These self-dumping rake designs make operation easier and quicker, permit you to clean a greater area faster. Both new rake types are now available as additions to the SMS line of standard rake designs.

SMS Leonard rakes operate directly on trash rack bars . . . ride down over stubborn obstructions and work them loose. Such freedom of movement assures fast, easy cleaning. Initial costs are low because the width of SMS rakes can be kept to the minimum required for handling for trash and the expense of guides attached to racks, or embedded in piers is eliminated. These rakes are of simple and rugged construction, designed for outdoor service and require minimum maintenance.

For full information on trash rakes and other SMS accessories, write to S. Morgan Smith Co., York, Penna. Request Bulletin 158 on Leonard rakes, or Bulletin 158A on new, self-dumping rakes.

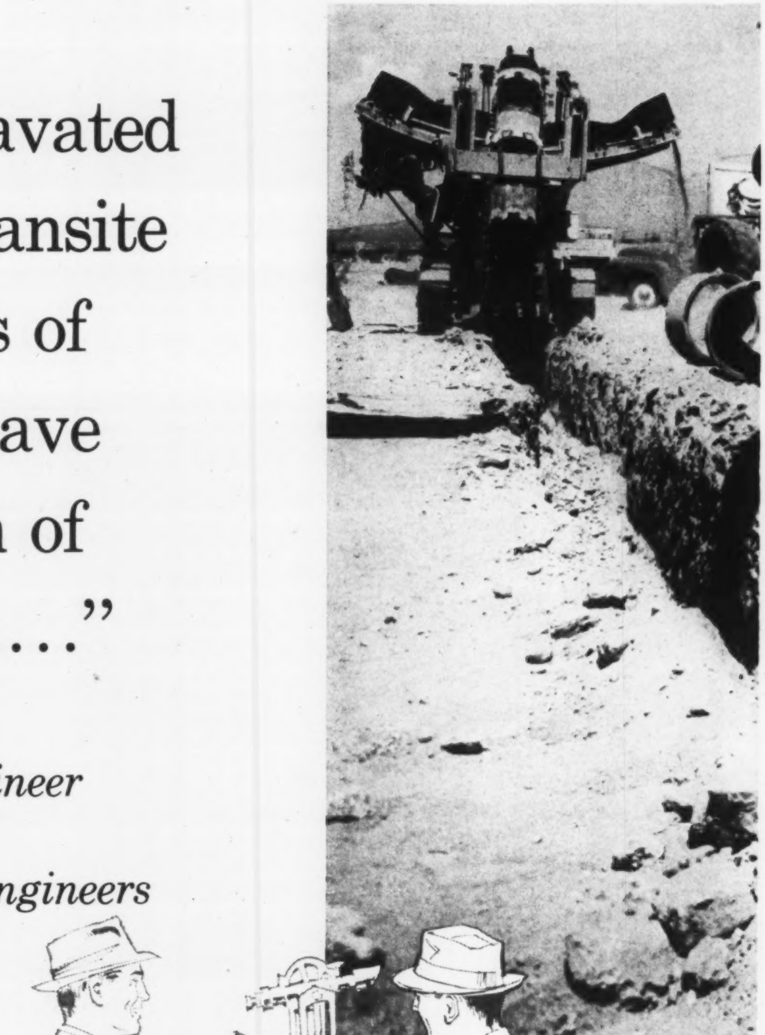
SMS
S. MORGAN SMITH
HYDRODYNAMICS

AFFILIATE: S. MORGAN SMITH, CANADA, LIMITED, TORONTO

Rotovalves • Ball Valves • R-S Butterfly Valves • Free-Discharge Valves • Liquid Heaters • Pumps • Hydraulic Turbines & Accessories

"We have excavated lengths of Transite after 20 years of service and have found no sign of tuberculation..."

says Consulting Engineer
Leigh O. Gardner
Yost and Gardner, Engineers
Phoenix, Arizona



"Transite has many advantages contributing to its economy. Its light weight, handleability and easy-to-join Ring-Tite Coupling keep our clients' final costs low. We find a continuing economy of operation throughout its long life. We have excavated lengths of Transite after 20 years of service and have found no sign of tuberculation . . . the smooth inside walls proving it still has low coefficient of friction and therefore highest carrying capacity."

Early installation photograph, Tucson, Arizona, where Transite has served since 1934. Still factory-smooth, these Transite water mains will contribute to pumping economy for many years to come.

JOHNS-MANVILLE
JM
PRODUCTS

Photo by Ray Manley, Tucson

Crews of F. J. Gallagher Trenching Co. installing 14" line in Tucson, Arizona

The lasting smoothness of Transite Pressure Pipe lowers operating costs . . . lets you cut installed costs, too!

Add Transite's interior smoothness to its non-tuberculating properties—and you see why it helps you design a water system that reduces community costs in two different ways.

You reduce installed costs. For Transite's high carrying capacity (flow coefficient, C=140) often lets you specify pipe of smaller diameter. And because Transite® can't tuberculate, you can design the system with no need to allow for future reduction in carrying capacity.

You reduce operating costs. Transite's maintained carrying capacity keeps pumping costs low. Its strength, durability and corrosion-resistance cut maintenance to a minimum, provide years of trouble-free service.

Transite's Ring-Tite Coupling assures a tight, lasting seal!

The Ring-Tite® Coupling lets you effect further savings: speeds installation to save time and labor costs; eliminates need for complicated equipment; assures tight seal at every coupling in the system.

Let us send you booklet TR-160A. Write Johns-Manville, Box 14, New York 16, New York.

JOHNS-MANVILLE

NEWS OF ENGINEERS

Ole Singstad

Ole Singstad, chief engineer and designer of the Holland, Lincoln, Queens-Midtown and Brooklyn Battery Tunnels, has been honored by the New York Chapter of the New York State Society of Professional Engineers with its annual award for "distinguished engineering services." A pioneer in the development of tunnel design and construction, Mr. Singstad is the subject of an interesting article in the October issue of *Readers Digest.* His most recent project is the tunnel under Baltimore Harbor, which will soon be opened to traffic.

Robert G. Macdonald of Alexandria, Va., has received a cash award and citation from the Quartermaster General, Department of the Army, for "sustained superior performance." He is supervisory general engineer and civilian chief in charge of construction and maintenance of facilities for all Army Quartermaster installations in the country.

E. R. Hendrickson, associate research professor in the University of Florida's College of Engineering, has been appointed to the newly formed Florida Air Pollution Control Commission. For the past five years, Dr. Hendrickson has been directing research and a graduate program on various phases of air pollution.

John A. Blume & Associates, Engineers, announce the new firm name and expansion to larger facilities at 612 Howard Street, San Francisco, Calif.

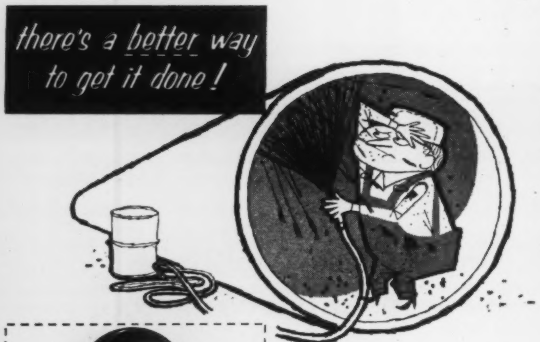
Carl L. Erb has been admitted to partnership in the firm of Howard, Needles, Tammen & Bergendoff, consulting engineers of Kansas City (Mo.) and New York, N. Y.

J. Moran Roberts, assistant manager of the municipal department of Robert & Co., Associates, Atlanta, Ga., has been elected vice-president of the firm. In his new capacity, Mr. Roberts becomes manager of the municipal department.

Harold E. Spickard has retired as chief of the Real Estate Division of the U. S. Army Engineer District at Los Angeles, after more than 23 years of federal service. Until 1955, Mr. Spickard held the active rank of Colonel. Mr. Spickard has established an office as a consulting engineer at 3355 Via Lido, Newport Beach, Calif.

F. J. Schneller, Jr.

Francis J. Schneller, Jr., was recently appointed to the Headquarters staff of ASCE as assistant editor of Technical Publications. Mr. Schneller received a B.S. degree in civil engineering in June 1956 from the College of Engineering at Rutgers University. At Rutgers he was an active member of the ASCE Student Chapter and a managing editor of *The Rutgers Engineer*. In January 1957, Mr. Schneller entered the U.S. Army for a six-month tour of duty.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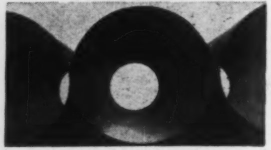
Coal tar lining is applied uniformly by centrifugal process



Provides mirror-like surface with a tight bond

Centrifugal spinning of coal tar lining to large diameter pipes, penstocks, and discharge lines, can now be done quickly, efficiently, and economically by specially designed equipment. Expert crews and complete mobile equipment available to serve you.

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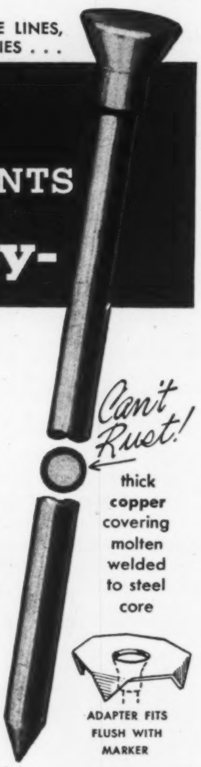
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*Trade Mark

Furnished in any desired length—in multiples of 6 inches. Packed 10 markers to a carton.

COPPERWELD STEEL COMPANY
WIRE AND CABLE DIVISION Glassport, Pa.

Write for Bulletin 144

Sol Ellenson, director of public works of Newport News, Va., was elected president of the American Public Works Association at its recent annual meeting in Philadelphia. Mr. Ellenson began his thirty-year career with the city as a junior draftsman in 1927, and was named to his present position in 1948.

Sol Ellenson

E. E. Rippstein, chief engineer of construction products, Laclede Steel Co. of St. Louis, has been elected president of the Joint Council of the Associated Engineering Societies of St. Louis. He succeeds retiring president **W. H. Giles.** Mr. Rippstein is immediate past-president of the St. Louis Engineers' Club.

Leland S. Rosener, Jr., Engineers, have become Rosener Engineering Incorporated, Engineers and Architects, maintaining the same key personnel with offices at 149 New Montgomery Street, San Francisco. The new corporation continues a private practice dating back to 1904.

Robert T. Lawson, formerly chief engineer of the San Francisco office of Dames & Moore, and **Warren D. Curtis,** former engineer-in-charge of its Salt Lake City office, have been admitted as partners in the firm. The main office of Dames & Moore is in Los Angeles.

Edgar F. Kaiser of Oakland, Calif., has been elected to the board of directors of Stanford Research Institute. Mr. Kaiser is president of Kaiser Industries Corp.; the Henry J. Kaiser Construction Company; Kaiser Engineers; Willys Motors, Inc., and the Kaiser Foundation.

A. W. Boynton announces the opening of a civil engineering practice in Arlington, Va. Mr. Boynton recently retired as hydraulic engineer with the Federal Power Commission after 23 years of government service.

Peter A. Strobel, who has continued to operate the firm of Strobel and Salzman since the death of **Joseph Salzman,** and **Dr. Paul I. Rongved,** consulting engineer, announce the formation of the partnership of Strobel and Rongved, with offices at 70 West 40 Street, New York City.

C. Andrew Pretzer, assistant head of structural design for McGeorge, Hargett and Associates of Cleveland, has been appointed chief engineer for Concrete Fabricators, Inc., of Cleveland.

Adelbert Diefendorf, professor and head of the department of civil engineering at the University of Utah's School of Engineering, has been appointed dean of the new School of Engineering at the College of the Pacific.

Earl Withycombe, assistant state highway engineer for the California Division of Highways, has retired after more than 34 years of service. During his long career with the division, Mr. Withycombe has served as resident engineer in the Fresno area, assistant construction engineer and construction engineer. **J. W. Trask,** district engineer in charge of District III at Marysville, has been appointed to the position vacated by Mr. Withycombe. **Alan S. Hart** has been promoted from district engineer at Eureka to engineer in charge of District III.

Michael N. Salgo, newly elected vice-president of the Metropolitan Section, has assumed duties as director of design and construction in the Facilities Engineering Services Department of the Columbia Broadcasting System. Mr. Salgo will be working on CBS's construction program.

Michael N. Salgo

J. P. Anderson has opened consulting engineering offices at 416 N. Glendale Avenue, Glendale, Calif. Mr. Anderson had been assistant superintendent of the Glendale Building Department.

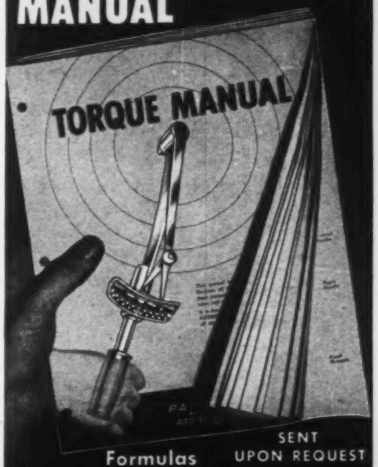
George A. Reznicek has been elected treasurer of the William L. Crow Construction Company of New York City. Mr. Reznicek formerly held the same post with the company, but since 1951 has been on special assignment in connection with the firm's overseas construction work. For the past six years he has been project manager on the construction of the strategic Wheelus Air Force Base in Tripoli and for an important Signal Corps facility in Eritrea, both under contracts with the Corps of Engineers.

Phillips H. Lovering has been appointed chief engineer of Andrews & Clark, consulting engineers of New York City.

Justin A. Seiler, former assistant city manager of Mansfield, Ohio, has been appointed division traffic engineer for the Ohio Department of Highways, Division 3, with headquarters in Ashland. Mr. Seiler has been associated with the Purdy Construction Company of Mansfield.

(Continued on page 32)

"TORQUE WRENCH" MANUAL



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FORNEY'S, Inc.
TESTER DIVISION
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News of Engineers

(Continued from page 31)

Hycon Aerial Surveys, Inc. has named William H. Cook (right), a member of the civil engineering faculty of Loyola University, to its Scientific Advisory Board. He is shown here with Harvey Ludwig, manager of sales and contracts.

Thomas G. Harton, Lieutenant Colonel, U.S. Army, has been assigned to Atlanta as the Inspector General for the Corps of Engineers for the south. Prior to his appointment, Colonal Harton served in the District Engineer Office at Vicksburg, Miss.

Carl M. Duff has retired as professor of engineering mechanics at the University of Nebraska after 37 years on the engineering staff. At one time he was responsible for the testing of most materials used by the state of Nebraska.

Robert G. Lovett, retired Brigadier General, U.S. Army, has been appointed manager of the new Kingston, Jamaica, office of Rader and Associates, architects and engineers of Miami, Fla. Since his retirement from the Corps of Engineers in 1954, Gen. Lovett has been on executive with Rader and Associates, in charge of the departments handling ports and waterways and engineering economics.

Frederick J. Dzialo has been appointed to the faculty of the University of Massachusetts. Prior to his appointment, Mr. Dzialo was a naval structural architect for the Bureau of Ships in Washington, D. C.

De Leuw, Cather & Brill and **De Leuw, Cather & Company,** have announced the appointment of **William A. McWilliams** as executive assistant to the managing partner of De Leuw, Cather & Brill of New York City. Mr. McWilliams was formerly director of the Delaware Memorial Bridge and chief engineer of the Delaware State Highway Department.

F. L. Endebrock, Captain, U.S. Navy, who has served for the past three and a half years as public works officer of the Puget Sound Naval Shipyard at Bremerton, Wash., is being transferred to duty as deputy district public works officer for the Eighth naval district at New Orleans, La.

Howard M. Bixby has been appointed to the engineering staff of the National Crushed Stone Association as field engineer, with headquarters in Washington, D. C. Mr. Bixby goes to the organization from the U.S. Bureau of Public Roads, with broad experience in highway engineering.

Charles G. Schilling has been appointed an assistant technologist at U.S. Steel's Applied Research Laboratory in Monroeville, Pa. Mr. Schilling goes to the Research Center after serving two years with the Army.

Joseph E. Havenner, director of engineering and technical services for the Automobile Club of Southern California, Los Angeles, has been elected president of the Institute of Traffic Engineers. Mr. Havenner, who has served in several important positions in the Institute, is widely recognized as a leader in traffic engineering work.

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FOR FAST, ACCURATE WORK

General Leveling — Measuring Heights
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Compact, dependable instrument made for lifetime service. Supplied with 4 scales held in milled slide ready for immediate use without removing and reversing arc frame. Precision controlled index arm gives accurate readings. Bubble magnifier adjusts internally—no eyepiece to retract for carrying . . . no re-focusing for every job.

4 STANDARD SCALES READY FOR INSTANT USE
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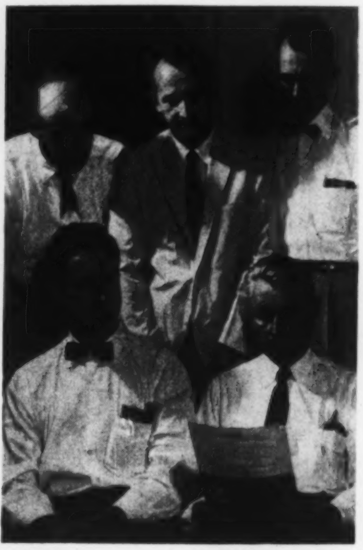

Employees of the Metropolitan District of Hartford, Conn. have organized an engineers club for educational and professional advancement. In a short time membership has grown from 47 to 100 employees. Shown here are the charter officers; seated, in usual order, are Jack Kuras and Frank Saliske; standing are Philip Smith, Albert Helt and Lawrence Johnson.

Andrew C. Paton has joined the home office staff of Metcalf & Eddy, engineers of Boston, Mass., as director of operations. Until his appointment, Mr. Paton was project manager of the architect - engineer joint venture of Metcalf & Eddy and Alfred Hopkins & Associates, engaged in the design and supervision of construction at the Thule, Greenland, Air Force Base and other northern installations.

Andrew C. Paton

James F. Haley and **Harl P. Aldrich, Jr.** announce the formation of the partnership of Haley and Aldrich, consulting soil engineers, with office and laboratory at 238 Main Street, Cambridge, Mass.

R. A. Bennett and **R. L. Jones, Jr.,** both of Augusta, Ga., have joined the staff of Patchen & Zimmerman, consulting engineers of the same city. **James Graves,** formerly with the Colorado State Department of Highways, has become associated with the firm.

Thomas F. Thompson, project manager for the Ralph M. Parsons Company, and consultant and technical adviser to the government of India in the development of irrigation ground-water resources, has returned to the United States. He will open a consulting office in the San Francisco bay area, specializing in engineering geology and water development.

Milo S. Ketchum, Jr. and **Edward V. Konkel,** partners in the Denver consulting firm of Ketchum and Konkel, have opened a new $85,000 building at 730 Kalamath Street. The firm has served as designer or consultant on many thin-shell concrete projects, and its new building reflects this interest, being a thin-shell concrete structure, without interior support columns or walls. The principals in the firm, in addition to Messrs. Ketchum and Konkel are **James M. Hastings, Rayburn A. Horton,** and **Edward R. Bierbach.**

M. S. Ketchum, Jr.

E. V. Konkel

(Continued on page 104)

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The safety
your design
reputation is
secure with
DURAJOINT —
the industry's
only 100%
watertight
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EXPANSION and CONSTRUCTION JOINTS
DURAJOINT and DURASEAL
Polyvinylchloride WATERSTOPS
for water-tight expansion and construction joints in concrete structures
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TESTED . . . and proven BEST!

Test after test, made by various independent research organizations, conclusively prove that DURAJOINT Waterstops are the only waterstops available on which you can stake the safety of your design and reputation. The results of these tests plus the many other advantages offered by DURAJOINT Waterstops are concisely stated in our new Waterstop Manual No. 457. Check and mail the coupon below for your free copy . . . it will make an excellent addition to your waterstop file.

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SINGLE PASSAGE IMPELLER

the New NON-CLOG PUMPS "by Aurora"

PATENT PENDING

AVAILABLE HORIZONTAL or VERTICAL

The BALANCED Impeller may be trimmed — to suit other heads and capacities — yet REQUIRES NO SEPARATE COUNTERBALANCE

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UNSURPASSED for HANDLING LONG STRINGY SOLIDS

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EXCELLENT NON-OVERLOADING CHARACTERISTICS

●

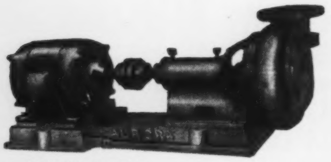
IDEAL FOR ELEVATING SEWAGE — PUMPING SLUDGE — HANDLING SETTLEABLE SOLIDS, EFFLUENT and OTHER WASTES

Aurora's exclusive MONO-VANE IMPELLER represents a major advance in the technique of non-clog pumping. Can be trimmed to various diameters — REQUIRES NO SEPARATE COUNTERBALANCE because it is in dynamic and hydraulic balance — therefore a wide range of operation. Built to Aurora's notable standards of quality for efficiency, long trouble-free service and economy. WRITE FOR BULLETIN 121-MV.

Aurora Type KU Vertical MONO-VANE Non-Clog Pump

A COMPLETE LINE OF AURORA NON-CLOG PUMPS

— of conventional types are available to meet every situation. We'll gladly send you BULLETIN 121-A.



Aurora Type KGG Horizontal MONO-VANE Non-Clog Pump

ENGINEERS

PUMPS "by Aurora" include pumps for every need in industry. Acquaint yourself with this distinguished line by requesting our CONDENSED CATALOG — a guide to the comprehensive line of Aurora centrifugal and turbine-type pumps. Aurora enables you to specify with confidence.

Your Inquiries Will Command Prompt Attention

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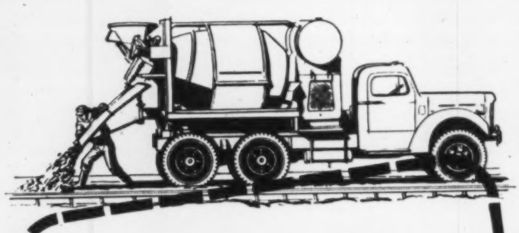
No time lost when concrete is



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with SOLVAY CALCIUM CHLORIDE

You save four ways when you order ready-mix that is "special winterized," including Solvay Calcium Chloride:

1. You save overtime finishing, because it sets faster.
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For the low cost of adding 2% of Solvay Calcium Chloride to concrete, you can actually maintain warm weather working schedules in winter. And you get *better* concrete! Ultimate strength at one to three years is actually 8 to 12% greater. Your product is more workable. With lower water-cement ratio, you get denser, more moisture-and-wear-resistant concrete.

SOLVAY ®

Solvay Calcium Chloride speeds but does not change the normal chemical action of portland cement. Impartial tests by the National Bureau of Standards prove its advantages in cold weather construction and concrete work. It is recommended or approved by leading authorities, including American Concrete Institute and Portland Cement Association.

Write now for full data!

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Boston • Charlotte • Chicago • Cincinnati • Cleveland • Detroit • Houston
New Orleans • New York • Philadelphia • Pittsburgh • St. Louis • Syracuse

170 Miles of Armco Piling used on New York Thruway

Along the 425-mile New York Thruway from New York City to Buffalo, and the 70-mile extension from Buffalo to Erie, contractors have driven nearly 900,000 feet of Armco Piling as foundations for bridges and underpasses.

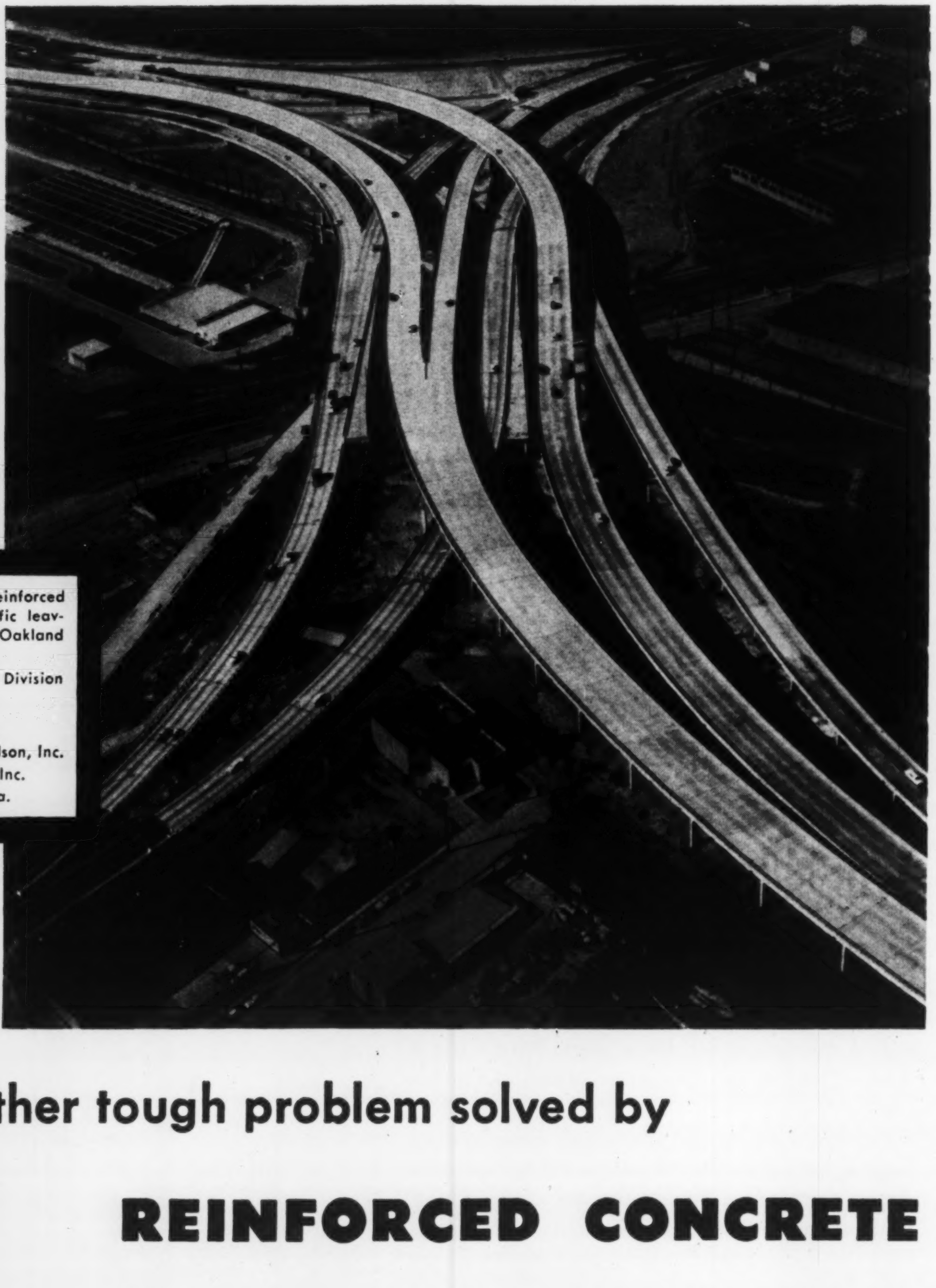
Leading engineers and contractors throughout the country have also selected Armco Piling and other Armco Construction Products for use on major highways such as the Pennsylvania Turnpike, Garden State Parkway, Indiana Toll Road, Kansas Turnpike, Turner Turnpike, and many others.

There is a size and type of Armco Product to help you solve almost any drainage or construction problem. Write us for helpful, authoritative data. Armco Drainage & Metal Products, Inc., 5107 Curtis Street, Middletown, Ohio. Subsidiary of Armco Steel Corporation. In Canada: write Guelph, Ontario. Export: The Armco International Corporation.

Armco HEL-COR® Pile Shell being driven by C. L. Guild Construction Co., for an overpass on Buffalo-Erie extension of New York Thruway.

ARMCO CONSTRUCTION PRODUCTS

ARMCO ®



Multiple overpasses of reinforced concrete distribute traffic leaving the San Francisco-Oakland Bay Bridge.

Designed by California Division of Highways.

Contractors:

MacDonald, Young & Nelson, Inc.
Morrison-Knudson Co., Inc.
San Francisco, California.

another tough problem solved by

REINFORCED CONCRETE

Think of the staggering problem in the design and fabrication of this multiple overpass if built of any material other than reinforced concrete. Its flexibility provided a quick and economical solution to the problems encountered in the design and construction of this complex structure.

Reinforced concrete has other advantages, too . . . it is rugged . . . highly resistant to wind, shock, and quake. Structures of reinforced concrete are lower in first cost and require less maintenance. Furthermore, all necessary materials and labor are readily available from local sources. Your project starts immediately and proceeds to completion without costly delays.

COMPARE
. . . and you will design for REINFORCED CONCRETE

CONCRETE REINFORCING STEEL INSTITUTE
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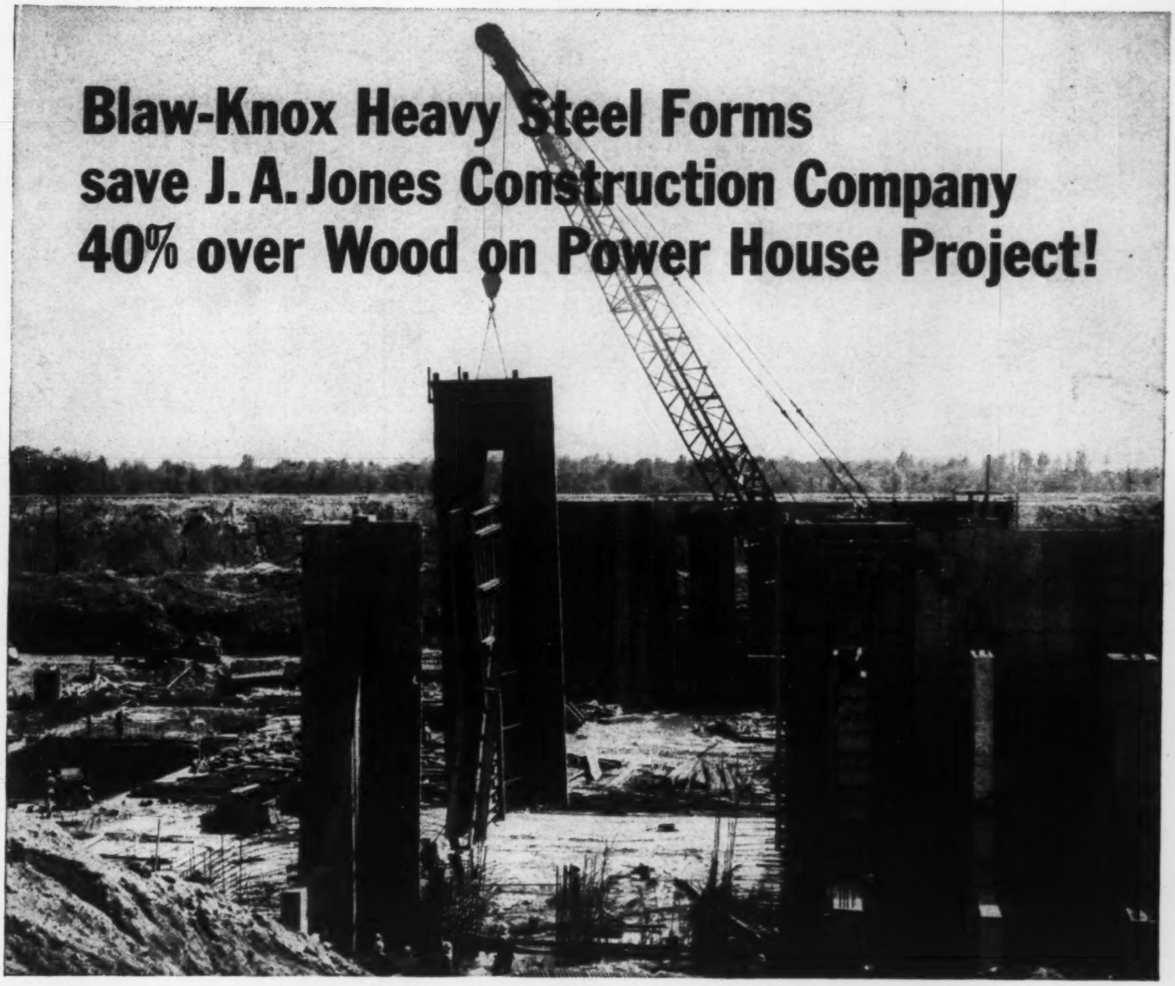

Blaw-Knox Heavy Steel Forms save J. A. Jones Construction Company 40% over Wood on Power House Project!

Backwall and counterfort form being placed. Handling time is cut to the bone by special form design. Form at right is ready for stripping and re-setting at new location.

Down along the banks of McKellar Lake at Memphis, one of the world's largest Steam Generating Stations is under construction. The J. A. Jones Construction Company, builder of the huge concrete substructure is using custom-built Blaw-Knox Heavy Steel Forms on a retaining wall that is 1,684 feet long and 41 feet high. They also are using Blaw-Knox Heavy forms for water intake, circulating and discharge tunnels.

Experience with more than 700 feet of wall shows that re-use of two sets of Blaw-Knox Steel Forms has actually saved 40% over the use of wood. Beyond this too, are the indirect advantages—safety, labor cost, uniformity of construction and salvage.

Advantages of custom-built Blaw-Knox Heavy Steel Forms have been proven on many construction projects of world wide interest. Where there is a concreting problem, the speed, flexibility, and salvageability of Blaw-Knox Steel Forms makes them the number one construction tool. They're backed by more than 40 years of experience on wide range of big projects.

Put the Blaw-Knox Steel Forms Consultation Service to work for you, whether your job is a dam, tunnel, sewer, or bridge. You'll get fast, simplified planning, custom-built forms tailored to the exact requirements of your project.

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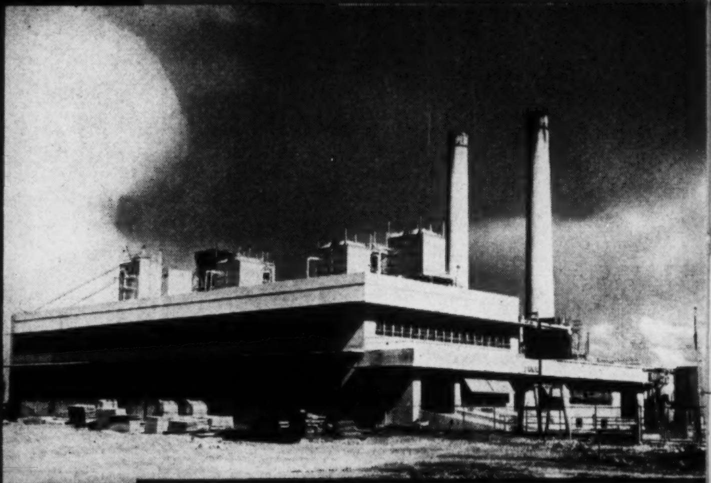
RAYMOND
CONCRETE PILE COMPANY



POWER PLANTS. Raymond installed the foundations for the power plant at the left in California while the power plant above, located in Puerto Rico, was completely constructed by Raymond.

OIL. Tanker pier in Australia (above) is another example of Raymond's complete construction services outside the United States. Typical of foundation work in this country is the Raymond supported refinery (bottom) in Toledo, Ohio.

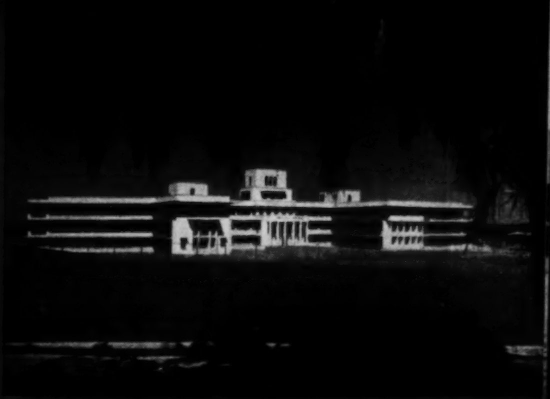
Raymond

THE COMPANY THAT LEADS A DOUBLE LIFE

FOR 60 YEARS, we have been recognized as one of the country's leaders in foundation work. While it's true we have completed more than 30,000 foundation and soil investigation contracts for important industrial and civic structures during this time, this represents only one part of our large scope of activities. In this country we also handle marine and heavy construction as well.

And abroad, Raymond provides a *complete* service for every type of general construction . . . from engineering studies and planning to the actual building of dams, power plants, oil refineries, housing, highways and hospitals.

This all began when we, as a pioneer in foreign construction work, *HIGHWAYS* *Our foundation experience plays an important part in the country's mushrooming highway program as evidenced by the work on the New Jersey Turnpike (right). In South America (below), Raymond engineers are playing a major role in Columbia's new network of highways.*



BUILDINGS *Above is a Raymond-built hospital in Venezuela while the bank building in Atlanta, Ga. is supported by our foundations—both excellent examples of Raymond's diversified activities.*

FULTON
FULTON

RAYMOND
specializes in foundation installations at home . . . and general construction abroad.

BRIDGES *Cuban bridge (above left) is an outstanding [illegible] complete construction services abroad. The Lake Pontchartrain [illegible] world's longest over water bridge, rests on Raymond [illegible]*

discovered it was necessary to enlarge our engineering and construction facilities to meet increasing client requirements. The more we expanded, the more services were needed, until today, we have completed over 1275 general construction projects abroad.

We cordially invite both governments and private industry to let us apply our skills for foundation, marine or heavy construction work here in the United States, or any type of general construction abroad.

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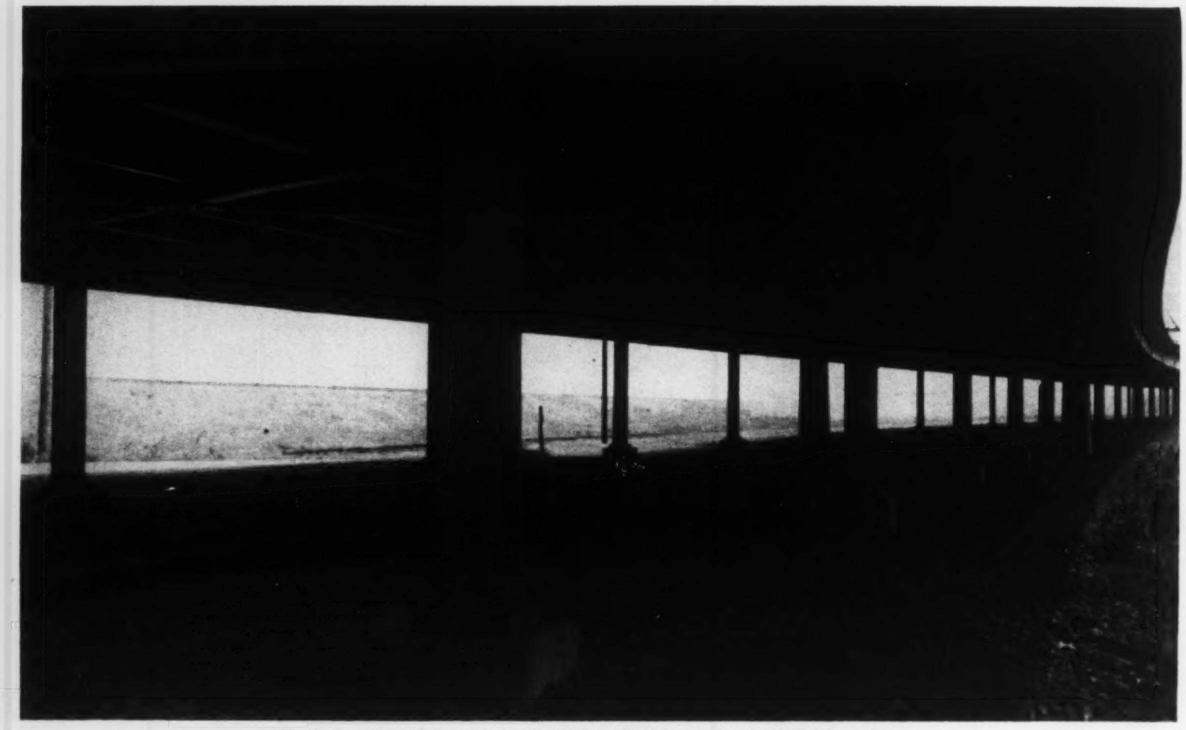
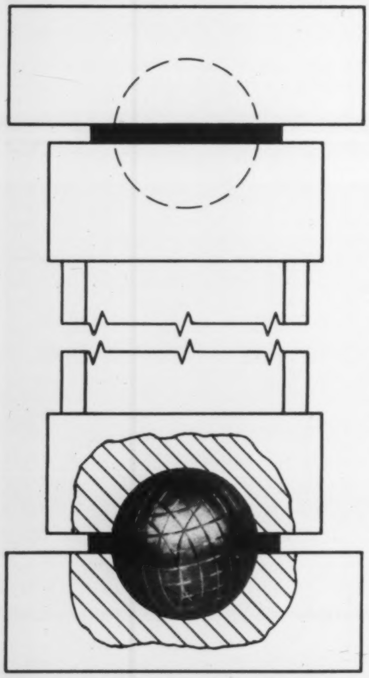


Typical portion of Gary viaduct on Indiana Toll Road, showing ball-joint columns.

Ball-Joint Columns Offer NEW Advantages in Bridge Construction

Move Freely in All Directions; Permit Simpler Design, Better Appearance



Schematic drawing of ball-joint column, with lower joint sectioned to show construction. Upper joint is of similar design. Stainless steel ball is grooved in three directions, to hold paste lubricant. Neoprene washer is in compression between bearing plates; seals out foreign matter and retains lubricant throughout the life of the bridge.

With a ball joint at top and bottom, these new-design columns move freely with all horizontal deflections of the structure, and are not subjected to high bending stresses. A horizontal truss beneath the floor beams provides lateral stability, eliminating bracing between columns.

These columns are of relatively small cross-section. Accordingly —

- They can be placed to bring the floor beams square with the bridge, permitting a much simpler structure than one with diagonal floor beams.
- Compared to concrete piers, these columns occupy much less ground area. Where the bridge serves only to span railroad tracks and other structures, this often permits a shorter, less costly bridge.

These ball-joint columns are in use on bridges of the Indiana Toll Road. The balls are hot-forged Type 410 stainless steel, heat treated to a Brinell hardness of about 240 and grooved to hold lubricant. The balls were furnished by Industrial Tectonics, in diameters of 6" to 11½".

We make precision balls of *all* materials, in all standard and special sizes from .005" to 24". *Write for further information* on ball-joint columns, and on balls for any other application that you may have in mind.

INDUSTRIAL TECTONICS, Inc.

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MANUFACTURERS OF PRECISION BALLS AND BEARINGS

3950 JACKSON RD., ANN ARBOR, MICH.

WESTERN DIVISION PLANT: COMPTON, CALIFORNIA

. . . . . Am-Soc Briefs

▶ ▶ Thoughts induced by the recent (October 14-18) Annual Convention. . . . Our Society and its effectiveness have grown and increased greatly over the years. The fortieth Annual Convention, held in Denver, Colo., in 1908, lasted from Monday through the following Tuesday. In this long period six technical papers were presented. By contrast, during the Convention just passed, 150 papers were presented. . . . A decade ago the Society had 143 technical and professional committees at work; today there are 275. Our 73 Local Sections and Branches held 580 meetings in 1946; so far in 1957 our 138 Sections and Branches have had 1,150 meetings. As recently as 1946, the sum total of technical papers presented at Conventions was 104; this year it was 317.

▶ ▶ Summer vacations for engineering students are a waste of time. . . . After protracted study the Board of Direction has declared itself for year-round utilization of both educational facilities and faculties, particularly in the training of civil engineers. New ASCE President Louis R. Howson, in discussing the Board action, called the present system of "nine months in class and three months on vacation . . . inefficient if not outmoded."

▶ ▶ Registration of professional engineers and land surveyors is in the best interest of the general public and an important step in professional development. In support of this policy, ASCE approves the Model Law; approves financial support of, and cooperation with, the National Council of State Boards of Engineering Examiners; endorses reciprocity by all state and territorial boards through the National Bureau of Engineering Registration; and recommends general requirements by which corporations can render engineering service to the general public on a fee basis.

▶ ▶ Early in December every member will receive a copy of the new-style Annual Report initiated last year. Advance copies, without the auditors' financial statement, were distributed at the meeting. If members will take the time to read the report through, they will have a good idea of the actions and activities of the Society during the past twelve months.

▶ ▶ UET has announced that Dr. Mervin J. Kelly, president of Bell Telephone Laboratories, Inc., will be general chairman of the business and industry campaign for the new $10,000,000 United Engineering Center. The campaign for funds will get off to an active start later this year.

▶ ▶ Past-President Enoch R. Needles, senior partner in the consulting firm of Howard, Needles, Tammen & Bergendoff, is nominee for president of EJC. In January he is expected to take office, succeeding Joseph W. Barker, M. ASCE.

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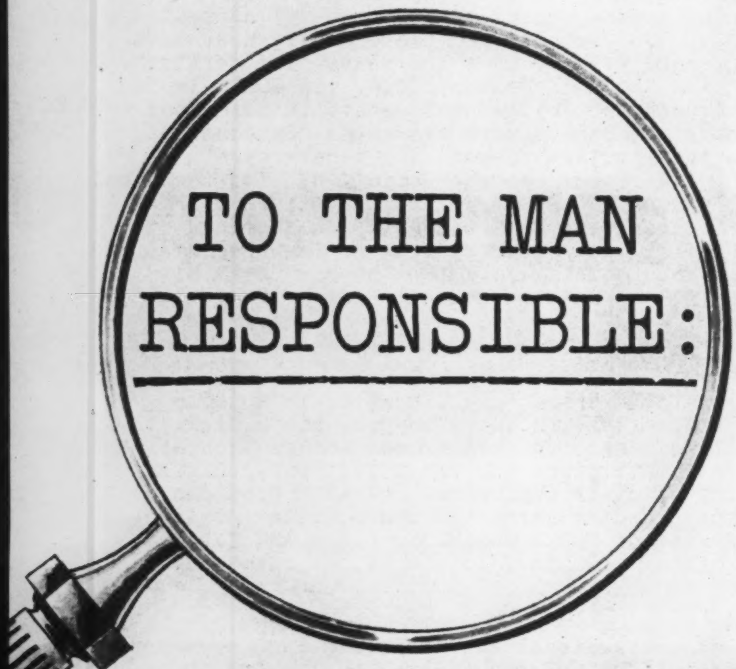

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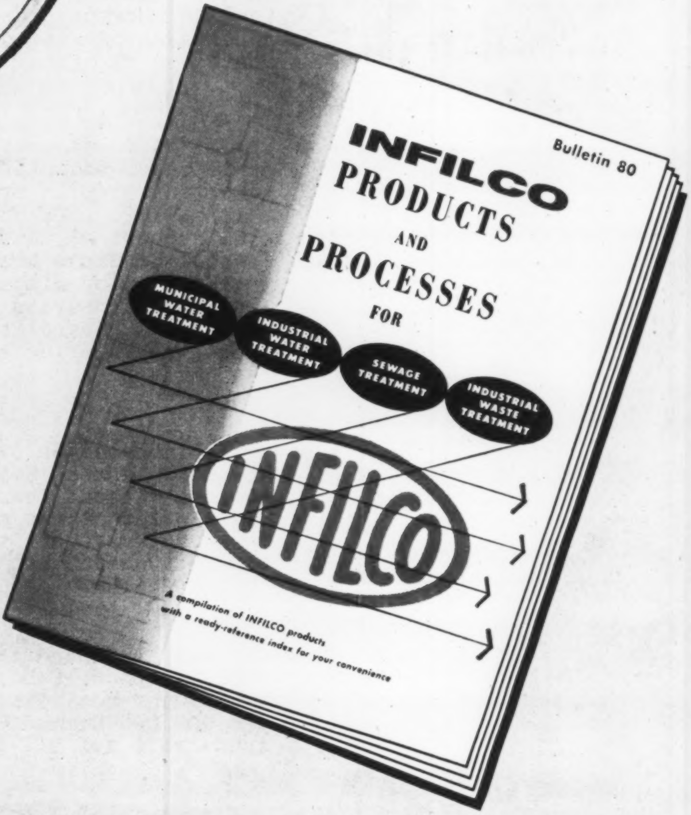
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do you know that

The dream of salt water conversion nears reality? This is the good word in a recent report from Interior Secretary Fred A. Seaton to Congress. With daily per capita water use in the United States 1,500 gal (a dramatic jump from fifty years ago when per capita consumption was 450 gal), the Office of Saline Water is banking heavily on a series of pilot-plant tests slated to begin late this fall. Currently regarded as the best bets are the Hickman rotary process of distillation by vapor compression; the Badger multiple-effect distillation process; plastic solar distillation; and the Lof process utilizing a solar still. Experts predict that in from ten to fifteen years conversion costs will be reduced from $1.96 to 50 cents per thousand gallons.

• • •

Japan is completing an under-sea vehicular tunnel? A double-deck highway tunnel, scheduled for completion next March, will connect the Japanese mainland and Kyushu, its southernmost island. With a length of over two miles, the structure will be second only in length to the 2½-mile Mersey Tunnel in England. Started in 1939 and interrupted by the war, the tunnel project was revived in 1956 as part of a toll road program to ease traffic. The cost will be about $14,000,000

• • •

Incineration is no longer a factor in Los Angeles smog? On October 1—after years of discussion and argument and preparation—the antiquated practice of backyard rubbish burning was abolished. Adoption of a plan for refuse collection and disposal for Los Angeles and the other 52 cities in Los Angeles County completes a ten-year county-wide abatement program. Existing industrial controls and the complete abandonment of refuse burning in open fires will keep more than 2,000 tons of contaminating materials from entering the atmosphere daily. Still to be reckoned with are motor vehicle exhaust, industrial-commercial solvent emissions, and contaminants from steam power plants.

• • •

Log Paper may have been developed by the late John R. Freeman? Prof. Marvin Bogema, of Cornell University, has sent the Society a sheet of logarithmic paper bearing Mr. Freeman's name and the date March 1894. It is the recollection of another member, Ernest W. Schoder, professor emeritus of hydraulics at Cornell, that Mr. Freeman had rulings made on lithographic stone for both 10- and 20-in. base paper—believed to be one of the first printings of this type of paper—in 1894 while he was engineer for what is now the Factory Mutual Insurance Company. Mr. Freeman—a Past-President and Honorary Member of the Society—died in 1932.

• • •

More than thirty research reactors are in operation or under construction in the United States? The annual cost of operating these atomic power reactors on an experimental research basis ranges from a low of $15,000 for a fractional watt laboratory unit to well over $200,000 for a 1,000-kw pool reactor. Full data on the reactors are now available in a 73-page illustrated booklet, entitled *U. S. Research Reactors,* available from the Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C. The price is $1.50.

• • •

This will be a banner year in steel output? With more steel made in the first eight months of 1957 than in any previous identical period in this country, the American Iron and Steel Institute expects that the output for the year will shatter previous records. To achieve this year's record production of 76.6 million tons, steel furnaces were operated at 88.5 percent of their capacity. Back in 1955, when the previous eight-month record was set, the industry would have had to operate at almost 95 percent of its then rated capacity.

• • •

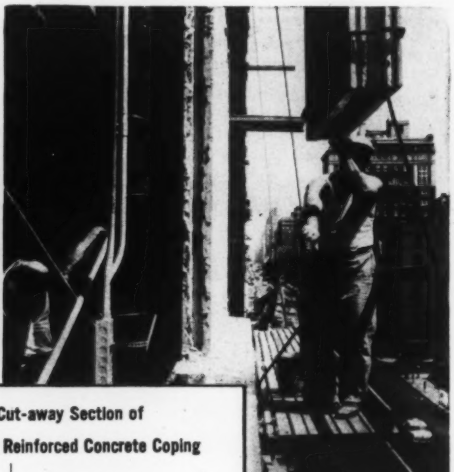
There is more aluminum in the world than any other basic metal? What scientists call "earth matter" contains more of the light metal than of iron, magnesium, and titanium combined. Actually aluminum makes up more than 7 percent of all earth matter. Bauxite has been found on every continent, in 44 countries, and is mined in 24 of them. These findings are reported by the Reynolds Metal Company.

• • •

Accurate surveys at bargain rates are now possible? In the Aleutians this summer the Coast and Geodetic Survey has been trying out a radar surveying device, called the Tellurometer, which made it possible to complete a four-month job in 14 working days. The device, consisting of a master unit and a remote unit, actually is a measuring instrument that determines the time required for a radio wave to travel the distance between the two units and return. Although the Tellurometer was developed by scientists in the Union of South Africa, it is particularly useful for fog-enshrouded areas like the Aleutians.

Going-Gone-Up!

PRECAST 'INCOR' CONCRETE PANELS SOLVE PROBLEM OF ADDING STORY



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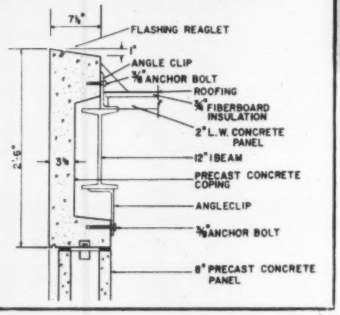
7⅛"
FLASHING REAGLET
1"
ANGLE CLIP
¾" ANCHOR BOLT
ROOFING
¾" FIBERBOARD INSULATION
2" L.W. CONCRETE PANEL
2'-6"
3⅛
12" I BEAM
PRECAST CONCRETE COPING
ANGLECLIP
¾" ANCHOR BOLT
8" PRECAST CONCRETE PANEL

Guiding panel into position. Panel in background is already anchored.

● World-famous Parke-Bernet Galleries in New York are headquarters for auction sales of fine furniture, jewelry, and works of art. The business has expanded so rapidly that it was necessary to add another story to Parke-Bernet's building.

The building's frame had been designed to carry only the existing number of floors with walls of Indiana limestone. The problem was to add a lightweight wall to match limestone.

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CIVIL
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Challenges of the future

L. R. HOWSON, President, ASCE

**Alvord, Burdick & Howson,
Consulting Engineers,
Chicago, Ill.**

Prepared from his address on taking office, October 16, 1957

My subject relates to the future of engineers and of the American Society of Civil Engineers. How many engineers will there be in the United States twenty years from now? How many will be members of ASCE, and how can the Society improve its usefulness to them? Why is it that engineers who have built everything needed by our exalted level of civilization have not yet built unity in their own profession?

The progress of a nation, or of an organization such as the American Society of Civil Engineers, depends upon what it is doing today and how well it is planning for the future. The past is important in recording both accomplishments and failures and in providing a springboard for future progress. But it is on our provision for the future that the present will be judged.

The solution of all engineering problems begins with an understanding of present and future requirements. A study of the engineering profession requires the same approach. Three scientists from the staff of the California Institute of Technology recently collaborated in a series of discussions with top-flight executives in thirty industries to explore future demands on our natural resources and our ability to meet them through technology. The results were assembled in a book entitled *The Next Hundred Years.*

Growth of the profession

Among the facts relating to engineers stated in this book or deduced from it are:

1. The number of 22-year-olds with college degrees will increase 50 percent in the next 15 years.
2. The number of engineering and scientific graduates has been and will remain at about 20 percent of the total of all college graduates.
3. Two-thirds of the engineering and one-third of the scientific graduates will continue in their respective fields.
4. The present total of 500,000 working engineers and scientists, according to the U. S. Census classification, will increase to 1,700,000 by 1980.

How will these facts affect ASCE and its future? First, how many members will ASCE have in 1980? A study of the past growth of the Society in relation to the increasing numbers of engineers furnishes an indication of the answer to these questions.

In 1900, according to the U. S. Census Classification, there were approximately 40,000 engineers in the United States. In that year ASCE had a membership of 2,221, the equivalent of 5.5 percent of all engineers. In the half century following 1900, the number of engineers in the United States increased more than ten fold—to 543,000. In 1950, ASCE had a membership of 28,105, or 5.2 percent of the total. Since 1950, the Society has gained slightly in its percentage of all engineers.

During the past two or three decades entirely new fields of engineering have developed but civil engineering has seen an almost complete disappearance of what probably was once the major field of employment for its graduates, that is, railroad construction. Nevertheless ASCE has experienced an average growth in membership equivalent to 6.2 percent of all engineering graduates. This indicates that ASCE is now serving at least as large a proportion of all the engineers in the United States as it was at any time in the past half century.

From the foregoing it may reasonably be expected that there will be more than 1,250,000 practicing engineers in the United States by 1980. If ASCE continues to keep abreast of its opportunities and obligations, its membership in 1980 should include about 75,000 engineers. It is none too soon to plan for orderly expansion to serve this increased number.

Participation in conventions

I suppose every new President of the Society has a program he would like to develop, and at the end of the year every President wonders how much of it has been accomplished. Of course a single year can see only the beginning of a long-range program, whereas those familiar with Society affairs have experienced the continuing cumulative growth of sound procedures started many years earlier.

One of the items to which I hope the Society will direct increased attention during the coming year is the attendance of members at, and their participation in, its conventions. For many years the registration at conventions, including ladies and guests, has averaged only 3 percent of the total membership of the Society. At several recent conventions the percentage of *members* attending was probably but 2 percent of the membership.

This is not a result of holding too many meetings in New York. In the past ten years 75 percent of all the conventions have been away from New York, in 20 different states. Neither does it appear to result from holding too many conventions. Available data indicate that the percentage of members attending conventions has progressively declined. It was 6.5 percent in the period 1926-1936, 5.3 percent in the period 1936-1946, 3.7 percent in the period 1946-1956, and 3.3 percent in the years 1955 and 1956. Such a decrease in members' interest is a matter for real concern.

Why do so few ASCE members attend and participate in our conventions? I think one reason is that the programs include too many subjects and too little material on each. Past records show that if a Technical Division schedules only one session at a convention, not more than 75 can be expected to attend. If it schedules two sessions, about 120 will attend, and if it schedules three or more sessions, devoted to generally related subjects, at least 175 can be expected to attend each session.

While ASCE, with 14 Technical Divisions, draws but 2 percent of its members to its conventions, other societies serving a single segment of the profession consistently attract 20 percent or more of their membership to their conventions.

ASCE conventions should be technically so attractive that members cannot afford to miss them. I believe the Division Activities Committee must exercise more control over program scheduling, and that each convention should schedule more sessions and papers from a smaller number of Divisions. The Divisions should be grouped for programming so as to provide a maximum of common interest in the subjects discussed. Under this procedure there would be just as many sessions and papers as now but each subject would be concentrated in one, or in some cases two, conventions each year instead of being split among three.

Most of our Divisions are doing fine work. However, too much segregation within the Society should be avoided, I believe, as it may lead to disunity somewhat comparable to that we are now attempting to correct in the entire engineering profession through Engineers Joint Council.

Unity in the profession

When founded in 1852, 105 years ago, ASCE was the only national engineering society in the United States. With the passage of time and the development of specialized branches of engineering, many other societies have been formed. For the past half century much attention has been given to some form of unity organization for all engineers. During this period many suggestions for organization have been put forward and a number of attempts made in that direction. As Past President Lockwood stated in his editorial in the August 1957 issue of CIVIL ENGINEERING, "Individual engineers want unity."

The Engineers Joint Council is a going federation of American engineering societies. It now embraces some fifteen societies with a combined membership of nearly 300,000 engineers. If it continues to serve the needs of engineering unity, it should include more than 600,000 engineers in the next twenty years.

As is always the case in the early life of federations, whether of political bodies or of engineering societies, there are divergent views as to the purpose, aims, and accomplishments of EJC. Time will either erase these differences or demonstrate so clearly the advantages of unity in the profession that what differences may remain will assume lesser importance.

I believe that EJC offers the best opportunity for unity in the engineering profession that has been presented in the past one hundred years. Undoubtedly future changes in it will increase its service to the profession, but I believe that the best interests of the profession will be served, *now,* if we give EJC an adequate, honest opportunity to demonstrate its value to the profession.

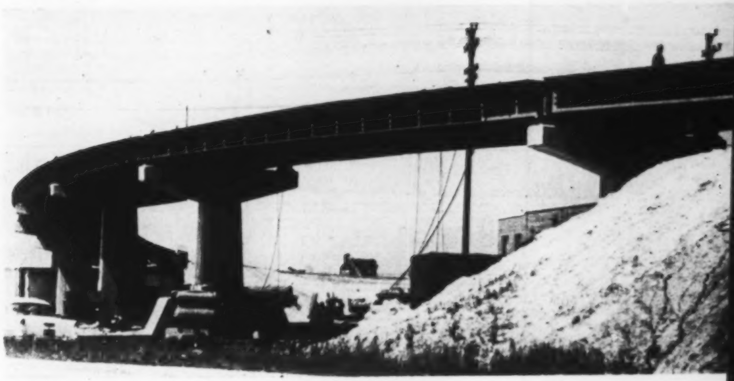
A recent suggestion of Past President Coover of the American Institute of Electrical Engineers proposes a distribution of responsibilities among three organizations such that EJC would be the medium for inter-society cooperation on technical matters only; the Engineers Council for Professional Development would concern itself with educational matters only; and the National Society of Professional Engineers (the only major engineering society in America not a member of EJC) would be the sole organization handling the strictly professional aspects of engineering.

EJC and ECPD are federations of substantially the same engineering societies. NSPE is not a member of either of these federations, although it has made application for admission to ECPD. It is believed that this proposal to segregate areas of responsibility would result in less unity in the profession rather than more, at least at the present time. EJC has a professional practice department whose activities under this plan would be transferred to a society not even a member of the EJC federation of societies. It would appear that NSPE, whose membership is only some 15 percent of that of the EJC societies, could function best as a constituent member of EJC.

The number of engineers in the United States has increased tenfold in each of the three preceding fifty-year periods. These engineers have demonstrated their ability to plan and build every conceivable facility required to give the United States the highest living standard of all times and places. Is history to record that they could design and build everything but unity in their profession? I hope not.

It is UNITY we are after. Let us concentrate on that single objective first, just as the American Colonies did. Having made a fine start through EJC, let us complete the job. Then through evolutionary rather than revolutionary processes let us develop and perfect this unity in the American way over the years, making changes as needed from time to time to conform to present and future needs.

May the engineer's ability to peer into the future never dim, and may his contributions toward making the world a better place in which to live continue to grow.



Access ramp on T-piers carries northbound Shell Road traffic into toll plaza on its way to Baltimore Harbor Tunnel. All photos by Max Araujo, Baltimore, Md.

WILLIAM F. NEALE, M. ASCE, Partner
W. F. HALLSTEAD, Highway Section
Whitman, Requardt and Associates, Baltimore, Md.

Engineering variety in Baltimore Tunnel approach

From accident-plagued Washington Boulevard southwest of Baltimore through the industrial miles near Fort McHenry to Pulaski Highway on the east, an army of heavy equipment is creating a revolutionary change in the landscape of historic Baltimore. South and east of this old port city, when the dozers and paving machines pull out, $130 million worth of construction will permit more than 12,000,000 cars per year to bypass tangled city streets as they travel between Washington and Philadelphia.

Among the timber yards and cracking plants of Fairfield and the railroad terminals of Canton, in suburban Armistead Gardens and Elkridge, 15 miles of dual expressway will sweep through 42 grade-separation structures, over four viaducts and three river and stream crossings to a twin-tube tunnel 6,300 ft long. This tunnel, built in sections and floated in, will carry up to 4,800 vehicles per hour beneath Baltimore's busy harbor. (See "Twin Tubes Placed by Trench Method," by Ole Singstad, M. ASCE, Civil Engineering, October 1955.)

The tunnel approach is designed to prevent its use by local traffic. When a driver enters the facility, he will be unable to leave it until he has paid the toll and traveled through the tunnel. This deliberate restriction of the approach highways to through traffic will prevent congestion by drivers who might otherwise be tempted to use the facility to clip a few minutes from a local trip.

The entire project is a bonanza for the student of highway engineering, but Design Section D-3, handled by Whitman, Requardt and Associates, Baltimore consultants, contains possibly the greatest diversity of engineering problems in one of the shortest sections of the project. This section of denied-access dual-lane highway includes six bridges and a directional interchange with almost a mile of access ramp. It requires the relocation of 0.7 mile of dual-lane city streets, 1.2 miles of industrial service roads, and a 14-lane toll-collection plaza—all in its brief 1.4 mile length.

Section D-3 is designed to meet urban expressway standards. Design speed is 60 mph and the one curve on the main line is superelevated with spiraled transitions. The approach roadway in this section has four lanes, consisting of two 25-ft paved strips separated by a non-mountable 4-ft concrete median. The pavement of the expressway and the toll plaza is 10-in. reinforced cement concrete.

Toll plaza on poor ground

The toll plaza had to be located in an area of questionable soil. Borings in this area revealed that below the top 20 ft of sand and gravel lay a stratum of silt 60 ft thick. The plaza was to crown a 30-ft-high fill on this unreliable material. See Fig. 1.

The silt layer, largely in AASHO soils classification group A-4, had to be stabilized to eliminate the possibility of future settlement, and just six months were allowed for this consolidation in the construction schedule. With only the 30-ft plaza fill bearing on the silt layer, the stratum would have required more than a year to reach its computed ultimate average subsidence of 1.8 ft. The loading on the existing ground would be 3.7 tons per sq ft with the normal plaza fill in place.

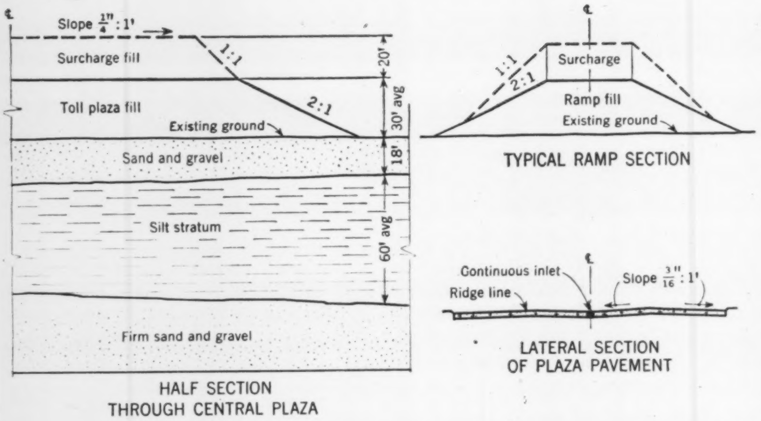

Slope $\frac{1}{4}$": 1'
Surcharge fill
1:1
20'
Toll plaza fill
2:1
30' avg
Existing ground
Sand and gravel
18'
Silt stratum
60' avg
Firm sand and gravel
HALF SECTION
THROUGH CENTRAL PLAZA
1:1
2:1
Surcharge
Ramp fill
Existing ground
TYPICAL RAMP SECTION
Continuous inlet
Ridge line
Slope $\frac{3}{16}$": 1'
LATERAL SECTION
OF PLAZA PAVEMENT

FIG. 1. Toll plaza had to be located on questionable soil, where surcharge fill was needed to provide adequate compaction within required 6-month period.

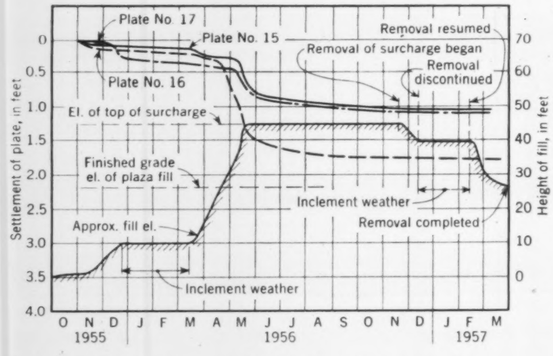
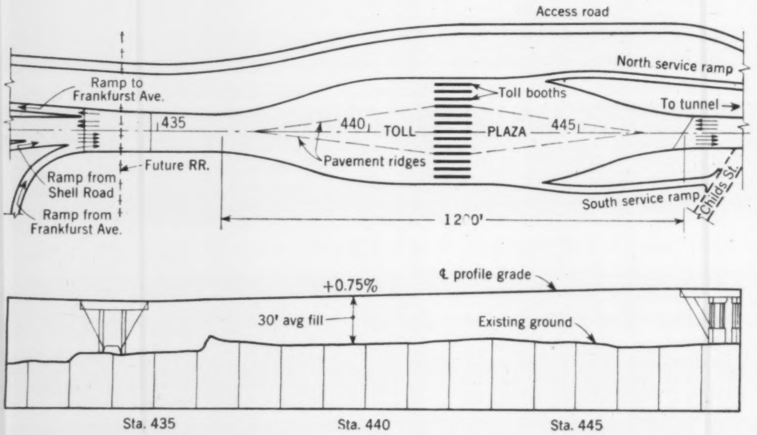


FIG. 2. When surcharge fill was placed over toll plaza area, 35 settlement plates were installed and pipe extensions were added as fill mounted. Readings taken on three plates are here plotted to show how 30-ft plaza fill settled under 20-ft surcharge fill.

FIG. 3. Toll plaza plan and profile give arrangement of facility designed to accommodate 4,000 vehicles per hour. Arrows indicate incoming and outgoing lanes.


Access road
North service ramp
Ramp to Frankfurst Ave.
Toll booths
To tunnel
435
440
TOLL
PLAZA
445
Pavement ridges
Future RR.
Ramp from Shell Road
Ramp from Frankfurst Ave.
South service ramp
Childs St.
1200'
℄ profile grade
+0.75%
30' avg fill
Existing ground
Sta. 435
Sta. 440
Sta. 445

To accelerate settlement, the permanent 30-ft plaza fill was topped with a 20-ft surcharge fill. This optimum surcharge depth was determined on the basis of the computations in Table I.

The surcharge fill was begun in April 1956, and placed to grade in 4-ft maximum uncompacted layers. Surcharge slopes in the toll plaza area were graded at 1 on 1 with no spillover. On the nearby approach ramps, the surcharge shoulder was carried to the edge of the permanent fill and the resulting spillover was graded at a 1 on 1 slope. See Fig. 1. This spillover was used on the comparatively narrow ramp fills to impose the required loading.

As the surcharge was placed over the ½-mile stretch between Frankfurst Avenue and Childs Street, 35 settlement plates were installed on existing ground beneath the earth mass to provide references for check readings. On these 3-ft x 3-ft steel plates, 4-ft lengths of 2-in. pipe were added as the fill mounted. When the surcharge was completed, level readings were taken semi-weekly on the pipe extensions.

Readings were plotted in chart form, as shown in Fig. 2. Note how the settlement increased as the surcharge fill neared completion. Through April and May of 1956, settlement was continuous. In June, the level-off began and successive readings revealed that the area had reached satisfactory consolidation by late autumn. Removal of the surcharge was completed in early 1957 and final grading of the plaza subgrade began. The surcharge fill was disposed of throughout the section as permanent embankment.

Plaza geometrics

Considerable information was available concerning the design and capacity of the toll booths themselves, but information on the channeling of traffic to and from the toll lanes was found to be spotty and uncoordinated. The designers of the toll plaza for the tunnel had to channel traffic into 14 toll lanes and back into the normal roadway section. The final design of the

TABLE I. Computations for depth of surcharge fill

ARBITRARY SURCHARGE DEPTH	TIME REQUIRED FOR 100% OF THEORETICAL SETTLEMENT	REMARKS
10 ft	9.5 months	3.5 months past schedule
15 ft	7 months	1 month past schedule
20 ft	5 months	Within schedule
25 ft	Under 4 months	Impracticable from standpoint of utilization of earth after removal

Baltimore plaza was based in part on information supplied by experience in the New York and San Francisco areas.

Unlike the toll facilities for the Lincoln and Holland Tunnels in New York, the Baltimore toll collection area is located well away from the tunnel proper—a half mile from the southwest entrance and just short of the first exit for traffic moving west from the tunnel. The plaza is set between a railroad bridge at its western end and a bridge over Childs Street, a city facility, at its eastern end.

This somewhat remote location was dictated by three considerations: (1) any toll-collection area must be located between its facility and the first public access to it; (2) no space was available closer to the southwest tunnel mouth for the Baltimore plaza because of the location of an existing railroad yard and the nearby Baltimore yards of the Weyerhaeuser Timber Co.; and (3) the general area in the vicinity of the northeast mouth of the tunnel was prohibitively industrialized.

The overall length of the plaza is 1,200 ft. See Fig. 3. At its broadest section—through the toll-booth area—it widens to 247.67 ft from curb to curb. Four lanes of traffic enter the plaza from the west—two on the main approach, one on the ramp from Shell Road Bridge curving in from the south, and one on the ramp from Frankfurst Avenue. Traffic from these four lanes has a distance of 550 ft in which to diverge into the seven available toll lanes. After passing through the toll-booth islands, this eastbound traffic has a 550-ft distance in which to merge into three lanes to cross the Childs Street Bridge. On the other side of the bridge, the outermost of these three lanes terminates in a 1 on 30 taper.

Traffic from the east enters the plaza in three lanes—two on the main approach, and an outside lane provided by widening the Childs Street Bridge an extra 10 ft. These three lanes diverge into seven in the 550-ft distance to the toll-booth islands, then merge back into three—two for continued travel on the main line, and one on the right for egress into Frankfurst Avenue. A part of this exit lane is to be used as a merging lane by vehicles moving inward from the outside toll booths.

The most disadvantageous merge will be encountered by a vehicle that has passed through an extreme outside toll lane and is converging inwards to a center lane. This merging vehicle must traverse a width of about 80 ft. In a converging maneuver, a vehicle follows a reverse curve. Using the minimum comfortable radii a vehicle must travel to merge inward from an extreme outside booth, the designers determined the 550-ft convergence length of the Baltimore plaza to be adequate at speeds up to 40 mph.

In early planning sessions, consideration was given to the idea of reserving the two outside toll booths of each bank of seven for truck traffic at a rate of 250 trucks per hour per booth. The remaining five booths, set aside for passenger vehicles paying a 35-cent toll, were expected to accommodate nearly 600 vehicles per hour per booth. This estimate was based partly on the following data showing the effect of tolls on toll-booth capacities on three New York facilities:

FACILITY	TOLL	VEHICLES PER HOUR*
Queens Midtown Tunnel	25¢	800
Brooklyn Battery Tunnel	35¢	650
George Washington Bridge	50¢ (or one of two kinds of reduced-rate tickets)	475

* Sunday afternoon traffic with a low percentage of trucks.

The estimate of 1,200 vehicles per lane per hour for Baltimore tunnel traffic was considered to be quite moderate when the plaza's capacity was determined. The maximum tunnel capacity per lane at peak flow could conceivably approach 2,000 vehicles per hour.

Thus 4,000 vehicles per hour could be expected to utilize each bank of seven toll booths—about 570 vehicles per hour per booth. With this flow, the planners decided not to reserve booths for truck traffic, but to open all seven booths in each bank to mixed traffic, using driver-side collection only. Although the acceptance of truck tolls at all booths will slow passenger cars to some extent, this retardation will be more than offset by permitting mixed traffic to pass through all the booths.

The 4-ft median of the approach expressway is not carried into the main toll plaza. The two center booths can be reversed, and if traffic demands warrant, 8 booths can handle traffic in the direction of heaviest flow. If the driving public persists in running true to form and neglects to utilize the outside booths fully, it is likely that temporary stanchions will be placed to channelize traffic.

The 20,000 sq yd of concrete plaza pavement is divided into three general drainage areas by two ridge lines. These ridges are 106 ft apart in the toll-booth area, and converge to meet the 4-ft expressway median at each end of the plaza. The pavement slopes laterally from these ridges at $\frac{3}{16}$ in. per foot to form a center swale and a gutter along each curb. These gutters are drained through welded steel grate inlets set 50 ft on centers. The center swale is drained through two continuous welded steel grate inlets 300 ft long, set in the plaza centerline.

Intersecting streets improved

The interchange at Frankfurst Avenue, a major city street, required the relocation of 3,000 ft of this avenue. The relocation ties into an industrial access road 24 ft wide and meets

Tunnel approach crosses yard of Baltimore and Ohio Railroad on two-lane K-truss bridge 22 ft above yard level. Unusual type of structure, 967 ft long, was erected in both directions from center pier, successive sections being supported on hydraulic jacks placed on falsework bents.

heavily traveled Shell Road (48 ft wide) at grade. At these two intersections, the designers worked closely with Baltimore's Traffic Commissioner to design channelizations that will be able to handle increased future traffic loads.

The relocation provided an opportunity to eliminate or ameliorate a number of deficiencies which increasing traffic had imposed on Frankfurst Avenue. The existing street had a 4-ft raised median which separated traffic successfully but provided no refuge for westbound vehicles waiting to cross Frankfurst's eastbound lane. The median of the relocated Frankfurst was widened to 25 ft at the Shell Road intersection so as to incorporate a storage lane for such waiting vehicles, and an acceleration lane for vehicles merging into westbound Frankfurst traffic.

In addition, Shell Road is channelized at its intersection with Frankfurst Avenue to provide storage lanes for traffic waiting to enter Frankfurst either eastbound or westbound, and to separate this waiting traffic from vehicles entering Shell Road. Thus, through close liaison with the City of Baltimore's Department of Traffic, the tunnel-approach designers incorporated these valuable improvements to two major city streets into their overall design.

Section includes six bridges

Design Section D-3, though less than 1½ miles long, requires six bridges. Four of these are standard twin overpasses carrying two roadways, a 4-ft raised median, and safety walks. A less standard bridge was designed to carry traffic from Shell Road into the facility. See Fig. 3. Here an 8-span structure capping a row of single T-shaped piers supports an approach ramp over Frankfurst Avenue. The ramp ascends in a graceful spiral 20 ft above the existing ground level to merge into the toll plaza.

The expanding classification yard of the Baltimore and Ohio Railroad, just west of Frankfurst Avenue, presented a unique bridging problem. Future plans for the railroad yard permitted construction of only one pier in the yard's 1,000-ft length. This pier, placed about halfway between the end piers, had to be skewed at about 45 deg to the bridge centerline to align with existing trackage.

Because of the skewed center pier, the normal end piers, and poor foundation conditions, arch construction was not used in this bridge. A study comparing subdivided trusses and K-type trusses revealed that K-trusses continuous over the center pier would be the most economical, primarily because of simplicity of erection in this case and low secondary stresses.

This K-truss bridge, clearing the railroad yard by 22 ft, is 967 ft long, with two continuous spans of 516 ft and 451 ft. Trusses are spaced 68 ft on centers with 64 ft between top and bottom chords. The panel points are 32.25 ft on centers because of the skew of the center pier. Piers are of reinforced concrete, supported on H-piles 100 ft long. Trusses are of structural and low-alloy steel with riveted connections and are continuous over the center pier with a fixed type of bearing. A rocker type of expansion bearing is used at each end pier. The deck, which consists of a concrete-filled steel grid floor with bituminous topping, is supported on composite I-beam stringers, connected to 6-ft deep plate-girder floor beams at truss panel points.

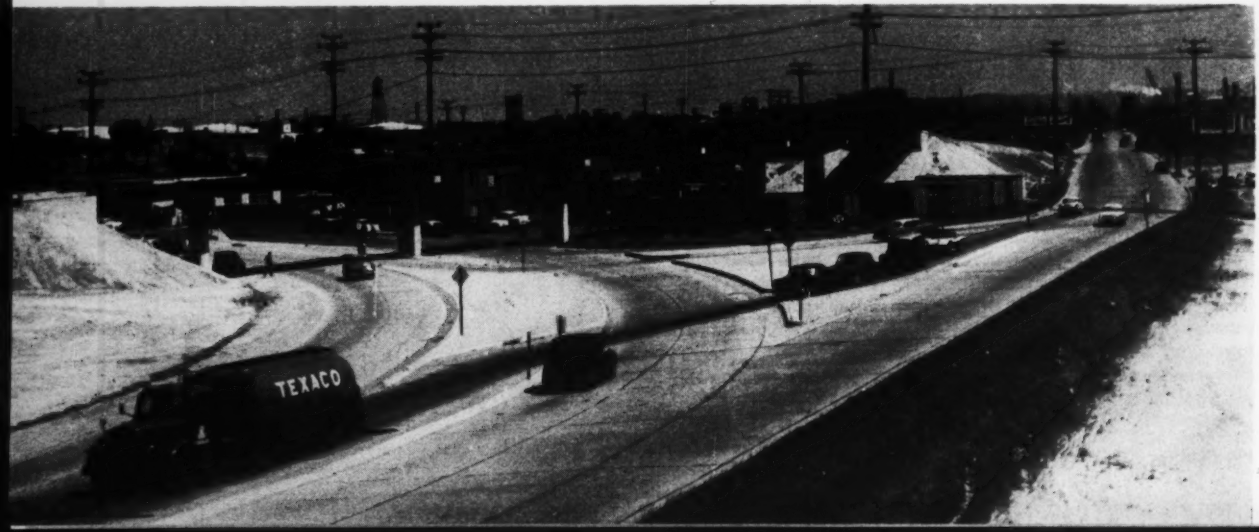
The bridge carries two lanes of traffic in each direction separated by a raised median 4 ft wide. Design loads are in accordance with AASHO standards for H20-S16-44 loading.

Extended K-truss construction is far from common. The Monongahela River Bridge at Pittsburgh includes about 400 ft of K-truss construction, and a non-continuous K-truss was used in a Montreal bridge. So far as is known, this bridge in Baltimore is the longest continuous K-truss ever built. Its erection was begun early in 1957 at the center pier, and progressed eastward and westward from the middle. As sections were added to the 90-ft-high structure, they were supported on standard hydraulic jacks set on falsework bents at ground level. Throughout the construction period, the B & O railroad yard beneath the bridge remained in operation.

The $130-million tunnel and approach system will open in December of this year. Design Section D-3, at a construction cost of $7,881,000, is short on length but long on engineering variety. In a distance of 1.4 miles it exemplifies many of the problems widely encountered in the design of the modern high-speed toll expressway.

The J. E. Greiner Co., Baltimore, is general consultant for the Harbor Tunnel facility, now under construction by the Maryland State Roads Commission. General Contractor is C. J. Langenfelder & Son, Inc., and the structural contractor for the K-truss is the American Bridge Division of the U. S. Steel Corporation.

Whitman Requardt engineers worked closely with Baltimore's Traffic Commissioner to channelize traffic at this intersection with Frankfurst Avenue. Note storage lane for waiting vehicles and channelization of traffic under access ramp to toll plaza.



BRUCE G. JOHNSTON, M. ASCE

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Developing intuition in structural design

In attempting to educate structural engineers, certain techniques of analysis and design are taught. But are the structural intuition and imagination of the prospective engineer developed in any systematic way? Structural imagination and intuition enable the engineer to create in his own mind a mental image of the behavior of a structure without the immediate benefit of mathematics or formulas. Of course such intuition is no substitute for formulas and formal analyses but it is an essential item in the equipment of the well-rounded structural engineer.

Those of us who are engaged in teaching structural engineering have a high regard for this type of imagination, and some of our interest in this area may spill over from time to time in our teaching. However, we need to find better means, on the undergraduate level, of developing these insights. The best aids are probably direct observation of the behavior of structures, man-made or natural, especially when under loads that produce motion in them, together with experience in cumulative design and analysis.

As Hardy Cross, Hon. M. ASCE, puts it in his essay, "For Man's Use of God's Gifts," in his penetrating book, *Engineers and Ivory Towers:*

"All nature is trying to tell something of how its forces act. The best information, the most valuable material, comes directly from nature. Men may try to duplicate her phenomena in a laboratory but we never exactly reproduce the true natural problem, never fully ferret out her secrets. The greatest engineers are undoubtedly those who best learn to speak the language of nature."

Paradoxically a study of engineering mathematics and the theories of elasticity, elastic stability, and plasticity can, if kept in proper proportion, contribute greatly to the development of more complete structural insight and perception. But these studies are generally not available to the undergraduate.

Some of the very best engineers have evolved from a background of early training in advanced mathematics. This result may occur when a mathematician is endowed with the engineer's sense of reality and a willingness to subordinate mathematics and make it a true servant and tool. Mathematics that remains abstract logic or pure science, though it may represent the highest type, offers little direct help to the imaginative mental processes of the engineer.

A recent book by Pier Luigi Nervi, translated from the Italian by Giuseppina and Mario Salvadori and published by F. W. Dodge Corporation in 1956, is entitled *Structures.* Nervi is famous as a combination of engineer, architect, and builder, and his structures are generally far more daring than those built in this country. They are designed largely on an intuitive basis but this ability is apparently founded on an apprenticeship of rigorous training.

Structural engineers will appreciate Nervi's high estimate of the place of constructional engineering in modern society. In Chapter 1 he states:

"Because of its varied aspects, of its persistence in time, and of the scientific, technological, esthetic, and social factors which influence it, construction may well be considered the most typical expression of the creativity of a people and the most significant element in the development of its civilization."

One of the greatest teachers of our time, from the point of view of developing structural intuition, is Hardy Cross, previously quoted. In the book by Cross and Morgan, *Continuous Frames of Reinforced Concrete,* Chapter 2, entitled "Statics of Deflected Structures," examples are given of indeterminate continuous beam and frame analyses prepared on an approximate basis as the result of simple free-hand sketches of the imagined structural action. A study of this chapter and practice in making such sketches will be particularly helpful in developing the imagination of the structural engineer.

A careful reading of the three books mentioned would be of help in developing imagination, intuition and structural perception in the undergraduate who is studying structures. Perhaps a definite reading sequence of these and other books should be required of all engineering students.

But of course no reading—no lecture—can provide the understanding gained by direct and intelligent observation of natural phenomena as they occur, with subsequent visualization of them in the mind's eye. The importance of such mental practice in the development of the fully educated structural engineer needs repeated emphasis in a day when there are all too many failures in both reinforced concrete and steel construction. These seem to be a result of a literal following of specification procedures without insight into the structural behavior that would have disclosed the fatal weakness.

Mental practice of the sort suggested will lead the designer not only to avoid weaknesses but to design boldly and safely using new forms and new materials, thus leading the practice of structural engineering toward the broader horizons of the future.

Los Angeles enlarges its sewage facilities—Part 1

Long land outfall built through

DAVID L. NARVER, Jr., M. ASCE,

E. H. GRAHAM, Jr., A.M. ASCE,

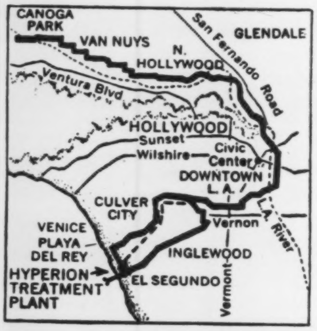


FIG. 1. Two major land outfalls supply Hyperion Sewage Treatment Plant until completion of expansion program now under construction.

Southern California is growing in population at a phenomenal rate. This is particularly true of Los Angeles and the small municipalities served by the city's sewerage system. Except for insignificant quantities, all Los Angeles sewage flows by gravity to the Hyperion Treatment Plant on Santa Monica Bay just north of the city of El Segundo. The existing plant has no faults of any consequence. Its capacity has simply been exceeded because of an extraordinary increase in population, impossible to predict.

The increase in the quantity of sewage became so critical that the state health authorities placed restrictions on Los Angeles as to the amount of additional sewage that could be put into the system. This in turn made it necessary for many houses to use cesspools, even though a sewer was available in the street in front of the dwelling. By mutual agreement between the state health authorities and Los Angeles, May 1958 was set as the deadline when the sewer system was to be capable of carrying all the sewage to the treatment plant. The present plant was capable of handling only a slight increase in quantity, so as soon as possible it was to be augmented to handle the additional flow.

Sewage from Los Angeles has been disposed of at the Hyperion site since 1894. At present the system consists of two major land outfalls conducting sewage to the Hyperion Treatment Plant. See Fig. 1. The plant treats practically all the sewage from the city, utilizing a high-rate activated sludge process at an average flow capacity of 245 mgd. The present plant was placed in service in 1951 and consists essentially of four mechanically cleaned bar screens, three detritors, eight primary sedimentation tanks, 32 aeration tanks, 20 final settling tanks, and an ocean outfall 12 ft in diameter extending approximately one mile out into Santa Monica Bay. In addition there are 18 sludge digestion tanks and a filter and dryer building for converting the digested sludge into fertilizer.

With the present ocean outfall it is necessary to chlorinate the effluent just before its discharge into Santa Monica Bay in order to comply with the rigid standards of the Water Pollution Control Board. This treatment is required throughout the year at an annual cost of about $200,000. All electrical energy used for operating the treatment plant is produced at the site. There is no connection to any outside source of power. Ten dual-fuel diesel engines, rated at 1,688 hp each, drive the generators and blowers, producing all the required electricity and compressed air. The diesel engines operate principally on gases obtained as a by-product of the sludge digestion process.

Two major items in the present scheme of operation account for about 50 percent of the annual cost. First is the heavy chlorination, and second, the cost of fertilizer production.

Citizens' Committee tackles problems

Early in 1954, Mayor Norris Poulson of Los Angeles appointed a Citizens' Committee composed of 21 community leaders whose task was to recommend the best method for meeting what was an emergency condition. This committee received help from

Baldwin Hills

Project Manager

Assistant Project Manager

Hyperion Engineers, Los Angeles, Calif.

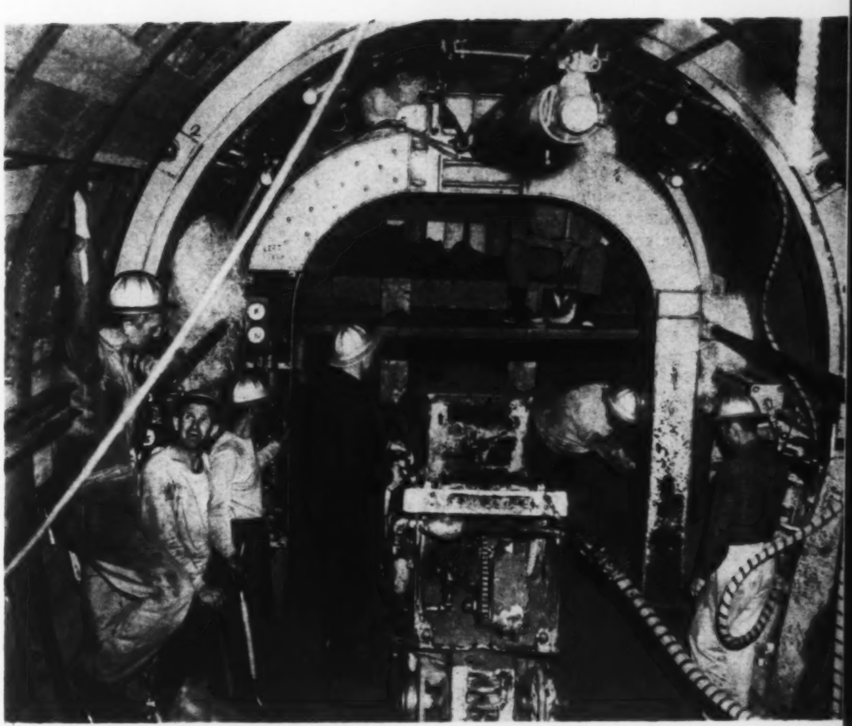
several consultants in the sanitary and public health fields.

The Citizens' Committee had a twofold purpose—first to increase the capacity of the existing system, and second, to reduce the operation cost as much as possible commensurate with adequate treatment. In November 1954, the Committee recommended the following facilities to increase the capacity of the Los Angeles sewerage system from an average flow of 245 to 420 mgd:

1. A new land outfall (the North Central Outfall Sewer)
2. Modifications and enlargements to the existing treatment facilities
3. An ocean outfall and pumping plant to discharge effluent five miles offshore
4. An ocean outfall and pumping plant to discharge digested sludge seven miles offshore
5. Major additions to the existing lateral-sewer collecting system

Items 1 through 4 were estimated to cost $40,700,000, and Item 5, $19,300,000. This program was submitted to the voters and approved in April 1955.

The basic plan for future operations, as recommended by the Citizens' Committee, is to modify the treatment provided at the Hyperion Plant in such a way that an average flow of 300 mgd will receive primary sedimentation only and will be discharged into the ocean about 5 miles offshore in a depth of 190 ft of water. The remainder of the future 420-mgd average flow will receive conventional activated sludge treatment in the existing aeration and final settling tanks and will then be either discharged at



Yoke and hydraulic pistons (view above) are used to drive shield for new sewer tunnel through sandy soil of Baldwin Hills. In completed sewer of 9½-ft diameter (view below), vinyl plastic lining covers upper 260 deg. Construction wires will be cut flush with concrete and pieces of plastic welded over openings to complete lining. Dimples and bulges between rows of mechanical locks will flatten considerably as concrete curing heat dissipates.

sea via the ocean outfall or reclaimed as industrial or ground-recharging water.

Sludge produced from the treatment process will be digested in the existing tanks and then either pumped through the 7-mile ocean outfall or, if economically feasible, dried for commercial fertilizer in existing vacuum filters and sludge dryers. At present the processing of fertilizer is not economically feasible, and the vacuum filters and sludge dryers will be "mothballed" until such time as it may become profitable.

Since the program was of a "crash" character and the Los Angeles Bureau of Engineering was busy designing the $19,300,000 worth of additional laterals, the Board of Public Works elected to engage the services of local consulting engineering firms to design $40,700,000 of the proposed sewerage program. Hyperion Engineers, a joint venture, was formed by the Los Angeles engineering firms of Holmes & Narver, Inc., sponsor; Daniel, Mann, Johnson and Mendenhall; and Koebig and Koebig. In June 1955 this group began preparation of the construction drawings and specifications for their part of the Citizens' Committee program.

New outfall sewer

Two major land outfalls are currently serving the City of Los Angeles, as shown in Figs. 1 and 2. The Central Outfall Sewer, constructed in 1908, has a diameter of 4 ft, and the North Outfall Sewer, built in 1924, has a maximum diameter of 10 ft. These two outfalls are seriously overloaded and require relief.

The new North Central Outfall Sewer, shown in Fig. 2, will convey sewage from La Cienega Boulevard at Rodeo Road to the Hyperion Treatment Plant. This sewer will be 9½ ft in diameter and 42,000 ft in length. Approximately 28,500 ft of its length will be in tunnel and 13,500 ft in open cut.

Several possible alignments were studied, and comprehensive geological and soil surveys made. Records of subsidence were available from a series of precise bench marks installed and periodically checked by the City of Los Angeles and the U. S. Coast and Geodetic Survey. Twenty-eight test holes were excavated along alternative alignments to obtain representative soil samples.

The most direct route for this sewer would be a 7½-mile tunnel through the Baldwin Hills. These hills rise to an elevation of about 1,500 ft above sea level and contain one of the major oil fields in the Los Angeles area. On this direct alignment the ground elevation at the upstream end is only 83 ft above sea level, and a gravity sewer on this line would include a section over 1,400 ft below natural grade. Because of the presence of areas of serious faulting and subsidence in the Baldwin Hills, a route was selected which runs along the north and west sides of this hilly region. On this route the active faults and subsidence areas are crossed at locations where relatively shallow open-cut excavation can be employed. The route finally chosen is approximately 3,000 ft longer than the most direct alignment.

After selection of the final route, 54 more test holes, averaging 75 ft in depth, were excavated along the proposed alignment. Five hundred undisturbed soil samples were collected between elevations 35 ft above, and 15 ft below, the proposed invert. Of these samples, 75 percent were tested to determine moisture, density, direct shear, and particle size. Ground water, where encountered, was chemically analyzed for chloride and sulphate contents.

In five of the 54 test holes, a 3-in. perforated pipe was installed, extending from top to bottom of the test boring so that a continuous record of water levels could be obtained during the construction phase of the project. These holes enabled the construction contractor to anticipate any water problem that might develop and proved to be extremely helpful during construction.

The present peak capacity of the combined Los Angeles outfall system is 650 cfs, of which 540 cfs is carried in the North Outfall Sewer and 110 cfs in the Central Outfall. Since the design peak dry-weather flow from the area tributary to the Hyperion Treatment Plant is 930 cfs, the combined capacity of these outfalls should be increased by at least 280 cfs. In the expanded system both of these lines will continue in operation.

The new North Central Outfall was designed with sufficient capacity to relieve the existing outfalls and to handle future flows, that is, 354 cfs when flowing three-fourths full. The free air space thus provided above the sewage, except for all but extreme storm conditions, reduces the build-up of sulfides and also allows this outfall to be used partly as a ventilation system to reduce odors escaping from the line.

The water surface in the new sewer at its junction with the existing system is 83 ft above sea level. But its water surface where it enters the Hyperion Plant must be kept below El. 36 so that the full capacity of the North Outfall can be maintained, and the weirs in the headworks building preclude lowering the hydraulic gradient at the plant below El. 34. These elevations limit the allowable head loss in the new sewer to 48 ft.

In designing the new sewer, Manning's coefficient was used. A careful investigation of existing sewers in the Los Angeles area showed that n values varied from 0.012 to 0.018 and that the most representative value was

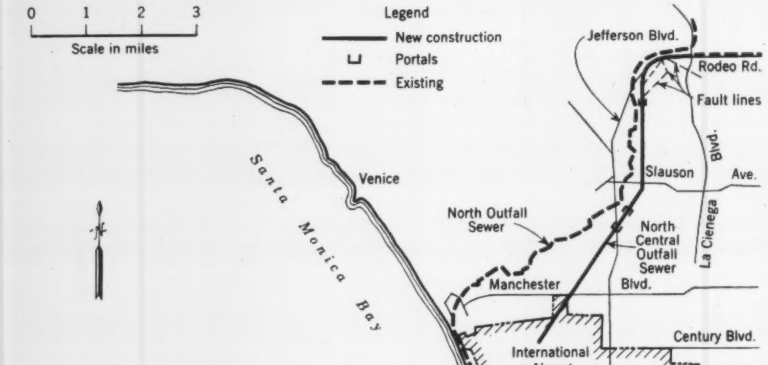


FIG. 2. New North Central land outfall, running between two older outfalls, has length of 42,000 ft and capacity, three-fourths full, of 354 cfs.

0.014. Consequently the new sewer was designed using this latter value, a flow of 354 cfs, and a pipe three-fourths full. These computations resulted in the selection of an inside pipe diameter of 114 in. for most of the line.

The available head made it possible to design the new sewer as a gravity line. There were, however, two low spots where inverted siphons had to be used. Minimum flows were calculated and, to minimize sedimentation, the siphons were designed to insure that a velocity of 1.5 fps would be maintained under low-flow conditions. Because of the large diameters of the siphons, 90 in. and 102 in. respectively, multiple-barreled structures were not deemed necessary.

Provision has been made to divert sewage from the new North Central into the old North Outfall Sewer in order to balance and control the flow. This is necessary to insure the highest possible velocity in both sewers during low flows. A 90- by 60-in. venturi meter is located on the North Central Outfall to provide the data needed for accurate flow control and also to meter the city's sewage.

Designed as two separate projects

To speed construction, the North Central Outfall was designed as two separate projects. Unit 1, the lower half of the line, is essentially a 20,000-ft tunnel. Unit 2, which makes up the rest of the 8-mile sewer, is about half tunnel and half open-cut construction. The tunnel section in both units was designed as a monolithic reinforced concrete arch to carry a vertical load of 2,500 psf and a horizontal load of 1,000 psf. See Fig. 3. The inside section is a circle of 114-in. diameter, designed for either a single- or a double-pour operation. The bottom 60-in. width on the inside is to have a steel-trowel finish for improved resistance to abrasion.

In view of the uniform sandy substrata revealed by the soil investigations, the contractor was permitted to choose the type and amount of tunnel support to be employed, and a lump-sum contract was adopted instead of a

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New land outfall has total length of 42,000 ft, of which 28,500 ft is in tunnel and 13,500 ft in open cut. Open cut was found economical wherever depth was 35 ft or under. Note that contractor elected to use precast reinforced concrete pipe in open-cut sections instead of optional poured-in-place construction.

unit-price type. A grouting program such as normally follows concrete lining in a hard-rock tunnel would be ineffective in this case because of the sandy nature of the soil. Vibration and other movements would cause the voids to be filled with sand long before grouting could be undertaken. Consequently the specifications for the tunnel sections required well controlled mining operations, and blasting was prohibited. Grouting, if required, will be done as extra work at stipulated prices.

Open-cut sections were also designed as monolithic reinforced concrete arches for normal trench and highway loading on underground conduits. These sections, like the tunnel, are circular on the inside. On the outside they are to be formed or poured against trench sheeting up to the spring line of the arch. For both tunnel and open-cut construction, the use of precast reinforced concrete pipe is permitted if preferred to a poured-in-place structure. The contractors who were successful bidders on both units elected to use the monolithic, single-pour concrete arch in the tunnel sections and to install precast, reinforced concrete pipe in the open-cut portions.

A unique feature of the North Central Outfall is the elaborate provisions being made for maintenance and cleaning. Large access structures are provided at intervals of about 5,000 ft and at each end of the inverted siphons. Through these structures a collapsible boat can be admitted in sections and assembled. The boat will be used for travel through the sewer in times of low flow for cleaning, inspection, and maintenance. Twelve access structures are provided, each 17 ft square, and some of them 90 ft below the ground. By utilizing these structures to carry out routine inspection, maintenance and cleaning operations, the useful life of this vital link in the outfall system will be materially extended.

Long and careful consideration was given the problem of concrete corrosion by hydrogen sulfide gas. An inspection of many large sewers in the vicinity indicated that corrosion had taken place in varying degrees. By far the most seriously affected line is the North Outfall in which, at several locations, corrosion has progressed to the point where actual structural failure is imminent. After a careful study of the probable causes of sulfide attack, three remedial measures were incorporated in the North Central Outfall: (1) elimination of excessive turbulence, (2) provision for adequate forced ventilation, and (3) installation of an acid resistant lining on all parts of the sewer above the minimum water surface.

Excessive turbulence was eliminated by providing smooth surfaces within the sewer, using large-radius curves for both horizontal and vertical changes in direction, and by careful design of transitions and junctions. In general, the minimum radius of curvature in a horizontal plane is 400 ft.

The forced ventilation system serves a dual purpose. Its major use, it is generally agreed, is to eliminate odors by maintaining a negative pressure in the sewer at all times. A second use is the protection that ventilation provides against sulfide attack by removing sulfides from the sewer as soon as possible. A 50-hp fan capable of delivering 20,000 cfm of air against a pressure differential of 9 in. of water was installed at the downstream terminus of the North Central Outfall. Air jumper lines ranging in diameter from 36 to 48 in. were constructed across the inverted siphons, and another jumper line will connect the North and North Central Outfalls so that a negative pressure can be maintained in both sewers through a major part of the line.

A third remedial measure against sulfide attack is the vinyl plastic lining to be installed on all parts of the sewer above the minimum water surface. The depth of liquid for minimum flow was calculated and the plastic lining extended 12 in. below this calculated line, with the result that the upper 260 deg of the outfall will be lined. The 12-in. freeboard is provided because inspection of existing lined sewers has indicated that sulfide attack is greatly increased in areas where the water surface falls intermittently below the protective lining.

The bond issue that made funds available for this program placed a strict limitation on the cost of each phase. Engineering estimates indicated that installation of the vinyl plastic lining throughout the entire length of the sewer might raise the construction cost above the sum allocated. Consequently an alternate design was prepared and incorporated in the bidding documents. This design utilized the vinyl plastic lining only at points of probable turbulence and for a limited distance downstream from inverted siphons. In the remainder of the outfall, about 2 in. of additional concrete thickness was provided to give longer life to the structure. This alternative was not considered as good as the complete plastic lining but was thought to be acceptable in case the construction cost for the fully lined section should exceed the available funds.

When bids were opened, it was found that the successful bidders on both Units 1 and 2 had submitted a figure that would permit installation of the complete vinyl plastic lining within the cost limitations. Consequently the North Central Outfall sewer, now under construction, will be fully lined throughout its 8-mile length.

Unit 1 was awarded to a joint venture of the Arundel Corp., L. E. Dixon Co., and Kemper Construction Co. for $6,196,691. Unit 2 was awarded to the Baker-Anderson Corp. for $4,930,000.

(In the next issue the authors will tell how the capacity of the existing 245-mgd activated sludge plant at Hyperion is being expanded to treat an average sewage flow of 420 mgd and to handle a peak flow of 720 mgd.)

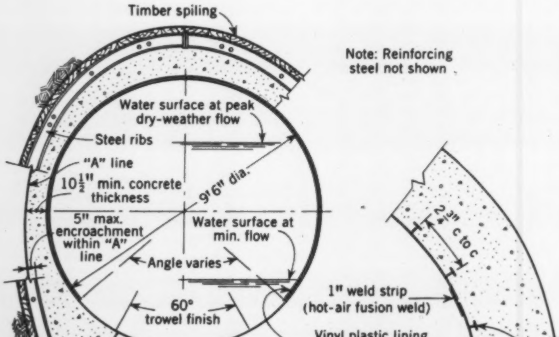

Timber spiling
Note: Reinforcing steel not shown
Water surface at peak dry-weather flow
Steel ribs
"A" line
10½" min. concrete thickness
9'6" dia.
5" max. encroachment within "A" line
Water surface at min. flow
Angle varies
60° trowel finish
15½"
Optional joint for single- or double-pour operation
2¾" c to c
1" weld strip (hot-air fusion weld)
Vinyl plastic lining (installed before concrete is poured)
Continuous locking extensions

FIG. 3. Tunnel section of new North Central Outfall sewer is being constructed as single-pour monolithic concrete arch. For details of vinyl plastic lining, see enlarged view at right.

lessons from COLD-WEATHER CONCRETE FAILURES

H. J. RACEY, Racey, MacCallum and Associates Ltd., Montreal, Canada

Ignorance and carelessness in winter concreting show up quickly with the arrival of warm weather. Frozen concrete may have some strength—and look good—until it thaws out. Unless its frozen condition is known and very careful provisions are made for supporting and curing it until it attains strength, frozen concrete can mean real trouble. With today's increasing pressure for year-round construction, the problem of cold-weather concreting becomes more important. Some Canadian experiences vividly prove that concrete cannot be trifled with in cold weather.

Trouble can start with the foundation. Some months ago the writer's advice was sought by a builder in difficulty. The footings of a four-story structure he was working on had been cast, as was subsequently established, on frozen ground. In this case the concrete froze before it could set, and the footings were in deep freeze for an extended period. The walls had been concreted and the superstructure level reached by the time warm spring weather arrived.

As the temperature increased, the ground under some of the footings thawed and the footings themselves commenced to disintegrate. Settlement occurred, resulting in serious damage and near collapse of a considerable part of the structure. A costly lesson was learned. Part of the structure had to be dismantled and rebuilt.

In another case, major collapse of a reinforced concrete building erected during the winter apparently was due to freezing of concrete. The damage to this structure is illustrated by a group of accompanying photographs. This three-story office building measures 200 by 80 ft, with a ground floor, first floor, second floor, and roof slab, all of reinforced concrete. Concrete columns are spaced at about 20-ft intervals each way. The construction time schedule was as follows.

On December 11 and 12 the roof slab was concreted. Tarpaulins, reportedly, were placed around the second floor, enclosing the placing areas. This was in accord with recommended practice but, sad to relate, at this stage good practice ended. No other provision was made for preventing the freezing of the freshly placed concrete.

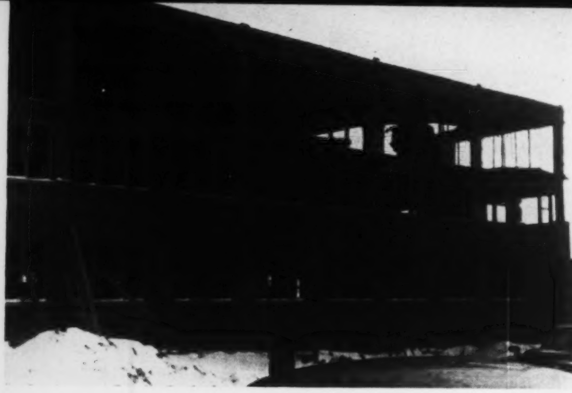
The roof slab was comparatively thin and exposed. Not being massive, it generated little heat from the chemical action of hydration to counteract the outside temperature. This dropped to 10 deg F on the night of December 12, the day placing was completed, and a light breeze was blowing. The air inside the tarpaulin enclosure, under the roof-slab forms, dropped to about the same temperature. This was the final concrete work in the structure. It was left to cure and gain strength.

On January 10, or 29 days later, when the concrete was considered to have gained design strength, shoring and form work were removed and the building was left until January 24, when brick work was started along one wall. Mild weather was forecast. On the morning of January 25 rain started and the bricklayers went home.

About ten minutes after the last man had climbed down from the scaffold, one whole section of roof slab collapsed. Frotunately no one was injured. An investigation was of course immediately started. It indicated that the last few panels of the roof slab, concreted on December 12, had frozen before initial set had progressed very far. The concrete had remained frozen until mild weather arrived late in January, when it rained. Temperature records and weather reports indicated that there had been a thaw late in December, while the forms and shores were still in place. Apparently this thaw did not last long enough to allow the concrete to defrost and cure sufficiently to support itself in the unfrozen state.

When the forms and shores were removed, the air temperature was well below freezing, so the concrete was still dormant and frozen around the reinforcing steel. The warm rain of January 25 finally thawed the concrete—and the structure collapsed.

Many tests were carried out on parts of the collapsed roof slab. Samples of frozen concrete were subjected to proper curing processes, and ultimate strengths of over 3,000 psi were obtained. This result indicated a probable low water-cement ratio in the original concrete, which decreased the



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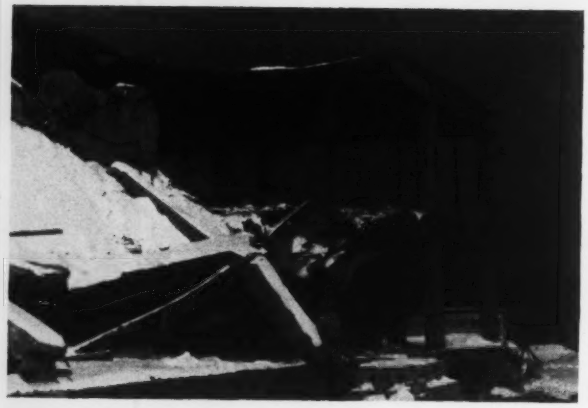

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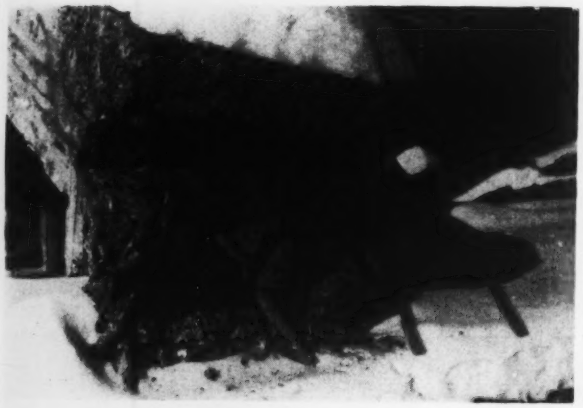

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Freezing of concrete before setting caused serious damage to a three-story office building in which columns, floor-slab, and roof were of reinforced concrete. As shown in (1), building looked fine until thaw came. Shoring was removed about four weeks after concrete was placed but failure, (2), did not occur until warm rains came, about six weeks after placing. In (3), note short dowels at base of column that failed when roof collapsed. Removal of broken slab, seen under way in (4), was a dangerous job which had to be done carefully to avoid further collapse of structure.

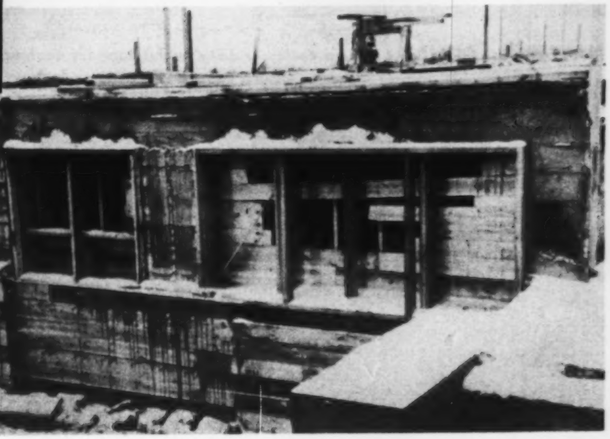
injurious effects of ice-crystal formation.

If remedial action had been taken early enough, there is a reasonable chance that this structure could have been saved. If shores and forms had been left in place and the slab subjected to careful moisture curing with moderate heat, it is the writer's opinion that the concrete would have gained a compressive strength comparable to that reached by the test pieces.

The curing process is greatly accelerated when a thaw takes place in frozen concrete, but alternate freezing and thawing cause disintegration and must be prevented.

In the case of this structure, the adjacent outside roof panels along the fallen section had to be removed as well as all the supporting columns. Physical removal of the collapsed section was hazardous to the workmen in the salvage crew and to the rest of the structure. Procedures had to be worked out so that no concrete would be knocked down carelessly. The impact of a large mass of concrete dislodged from the roof slab, and landing on the second-floor slab, could have caused severe damage to the structure.

Another problem was the legal responsibility of the salvage company that removed the condemned parts of the structure. A very carefully worded contract was drawn up and the structure was inspected both before and after the demolition work was carried out. This was done to protect the salvage company from blame for defects in the building not due to demolition. The lesson learned from this concrete failure cost the contractor a very large amount—bankruptcy.



Vigilance is necessary during northern winters to avoid some accumulation of snow or ice in forms. Honeycombing along lower sides of beams shown in view at left was caused by snow left in forms, which was thawed by heat from setting of concrete. In this structure, beams had to be chipped out, but slab was saved. In view below, frozen snow formed part of beams over windows. Note void at right, perhaps caused by packed snow in form. Needless to say, these views do not represent usual construction practice.

Carelessness in leaving snow and ice in forms is almost certain to bring serious difficulties. Since heat rises, ice or hard-packed snow will not be thawed even when warm concrete is placed on top of it. Voids as well as frozen concrete will result. Extreme cases have been observed by the writer. On one job, the columns were supported only on the steel reinforcing bars, which were exposed when the ice and snow in the bottom of the form had melted away.

Failures have been caused by the subsidence of unfrozen, green concrete, which had not hardened sufficiently to support itself before the ice and snow on which it had been placed, had disappeared. Honeycombing occurs where ice or snow slowly thaws as a result of the heat of hydration of the concrete.

On one job where snow was not cleaned out of the forms before the concrete was placed, large areas of packed snow formed an integral part of the concrete beams over the windows. This building wall was poured in mid-winter in sub-zero temperatures. A few hours after placing, the contractor was surprised to discover that the concrete had frozen. Advice was sought and an inspection made. The concrete was good but solidly frozen.

The contractor was advised to cover the slab with straw and tarpaulins, to enclose the area under the slab, and to circulate heat through the enclosure. This was done at considerable cost. During the night, forms and tarpaulins caught fire, leaving the concrete unsupported. Large voids which formed around the lower tension bars rendered the entire slab unsafe and useless as a structural component. Whether this failure was caused by ignorance or carelessness is not important—the price of the lesson was high.

Carelessness of this sort not only increases the contractor's cost but also requires the supervising engineer to keep men on the job for a longer period. The owner's use of the structure is delayed. Thus good concrete on the first try is everyone's business.

Better concrete in the future—not exploitation of past errors—is the object of this discussion. Needless to say, the accompanying illustrations do not represent usual construction practices in Montreal. These are isolated cases. But constant vigilance is required on even the best planned jobs to prevent small amounts of snow and ice from being left in the forms, or the freezing of corners in isolated places. Despite repairs, a structure that suffers such damage is permanently weakened and its cost is increased.

Adequate specifications are the first requisite. For example, the conditions under which footings are to be placed must be clearly specified to ensure that the concrete will not be placed on a frozen subgrade. If the weather is likely to be cold at the time of placing, provisions for preventing the ground from freezing must be adequate. If precautions are overlooked, failures will often occur.

Air temperatures and wind have the greatest effect on loss of temperature in concrete. Weather forecasts give some advance warning, but often come too late for the installation of adequate heating devices unless these are readily available. Specifications should include very definite provisions regarding the availability and adequacy of protective materials when concreting is started. Heating, enclosing, and covering facilities must be on hand early enough to maintain temperatures above the permissible minimum during those first critical hours when initial set is taking place. And the heat must be maintained until the concrete has attained its minimum strength.

Winter concreting can be accomplished successfully and economically. It requires knowledge, advance preparation, and vigilance.

(This article is based on the paper presented by Mr. Racey, a member of the Engineering Institute of Canada, at the ASCE Buffalo Convention. It was given before a Structural Division session presided over by George S. Vincent, a member of the Division's Executive Committee.)

Landfill gas burned for odor control

WALTER L. DUNN, Assistant Professor and Campus Sanitary Engineer,
Department of Public Health and Preventive Medicine, University of Washington, Seattle

Area adjoining University of Washington campus is loaned to City of Seattle for sanitary landfill. Pipes capped with "A-frames" mark location of gas burners installed to reduce odors.

A "useful accident" occurred at the Union Bay refuse disposal site on May 8, 1956, when data were being obtained for a settlement and temperature study. Union Bay, a part of Lake Washington adjacent to the University of Washington campus, is loaned by the University to the City of Seattle for one of its disposal sites.

Uneven settlement opened a large crack in the earth cover over the refuse, and although it could not be observed from more than a few feet away, a very hot gas fire was discovered burning at one place in this 1½- by 30-ft fissure. The earth within the crack was red hot, appearing similar to the inside of a firebox. Refuse was not burning—only gas—so there was no visible smoke. The next day the fissure was covered with several truckloads of earth, which extinguished the fire.

Previously it had been noted that wherever cracks developed in filled areas very putrid odors were emitted, but until the fire occurred it was not realized that relatively large amounts of methane gas were being produced by the biological breakdown of garbage. At other locations gas bubbles can be seen, where water accumulates on the surface and along the edge of old fills that have settled into the swamp. After a heavy rain the gas actually makes a hissing sound as it escapes through small openings in the earth cover.

Because this refuse disposal site is very close to the University, to a new shopping center, and to residential housing, many complaints have been received about odors. These are particularly bad when air conditions are

Two sizes of screens were tried on bottoms of pipes set into landfill to collect gas, as seen in view at left. Smaller screen has proved as effective as larger one. Tops of pipes carry burners of low-pressure flame-retention type. In center view, burner is shown in operation with "A-frame" vent in place to protect flame from wind. In view at right, taken at dusk, vent has been removed to make flame visible.

stable and wind velocities are too low to accomplish mixing and dilution.

Remembering the "accidental" gas fire, it was decided to try controlled burning of the waste gas to reduce odors. On September 14, 1956, the first burner was installed at approximately the location where the fire had occurred. The burner consisted of a water well-point attached to 1¼-in. sections of pipe driven through the earth cover and penetrating into the layer of mixed refuse. It was found that burning the methane gas destroyed the putrid odor associated with it.

Some experimenting was done with flame arresters, retaining gas burners, sheet-metal flame protectors, and other types of burners. It was found that an inexpensive burner could be made from surplus 1-in. tubing. The length of pipe needed depends on the depth of cover over the garbage, but 6 or 7 ft is ordinarily sufficient. Instead of a well-point, a short piece of ¼-in. wire-mesh screen is welded onto one end of the pipe, and this simple burner is placed with a back-hoe digger mounted on a rubber-tired tractor.

The screened end of the pipe is set into the refuse 6 to 12 in., and then earth is compacted around it. A low-pressure flame-retention gas burner made of a circular piece of 24-gage stainless steel, perforated with 1/16-in. holes, is inserted about 2 in. below the top of the pipe. A 6-in. galvanized sheet-metal vent, or "A-frame," is then fastened over the burner end of the pipe to protect the flame from the wind. The burners are made and installed under the direction of Howard G. Moore and Martin B. Paulson, foremen in the University Buildings and Grounds Department.

Two sizes of screens were tried on the bottom of the burners, as shown in a photograph. The smaller one seems to be as effective as the larger. About 15 of these burners have been installed, as close together as 75 ft where the mixed refuse is several layers thick. They are generally placed where cracks develop and at high points in the fill.

Analyses of the gas made by Harley H. Bovee, Research Chemist, Environmental Research Laboratory, University of Washington, indicates that its composition is almost entirely methane and carbon dioxide. The amount of odor-causing compounds is estimated to be only a fraction of 1 percent. Tests made to date indicate an average of about 65 percent methane and 35 percent carbon dioxide—a composition quite similar to sewage-sludge gas, which is often captured in a digester and burned.

Since the burners have a tendency to go out from time to time, two of them were recently equipped with "pilot lights" made from 5-gal trailer bottles of propane gas equipped with a pressure regulator and small burner. Each container burned about 10 days, but adjustment of the burners may extend the life of a bottle to two or three weeks. Because of the expense of equipping 25 to 50 burners with pilots, ignition by hand on days when the weather is stable may be the most satisfactory method of relighting. A convenient lighter has been made from a spark induction coil operated by two dry-cell batteries.

The static gas pressure developed in the burners is very low, equivalent to only about ¼ in. of water. The velocity and amount of gas escaping from the burners when not ignited is variable, but an average burner gives off about 0.7 cfm. However, after ignition the flow may be increased, as the heat developed seems to produce a draft by reducing the pressure at the burner.

The principle involved in burning refuse gas is to maintain as tight an earth seal over the refuse as possible, then bleed off the gas at selected locations. Observations indicate that the effectiveness of refuse gas burners at Seattle's Union Bay site is dependent on at least five factors:

1. The effectiveness of the earth cover as a seal. If cracks develop in the vicinity of a burner, pressure may be reduced to the point where the burner is extinguished. Continuous scarifying of filled areas is necessary to prevent loss of pressure.

2. The strength of prevailing winds. Odors are carried to adjacent areas most readily when wind velocities are low—less than 6 or 7 mph. When the wind velocity is greater than this, the burners are usually extinguished. However, high winds dilute the putrid gases and so relieve the odor situation. At present the burners are relighted individually every few days as they become extinguished.

3. The amount of moisture in the garbage. Gas production is slow when the refuse becomes dry. It has been observed that when cells settle below the water level of the swamp, or when surface water percolates into the refuse, gas production increases.

4. Depth of refuse. Most gas is produced where refuse was formerly placed in layers 20 to 40 ft deep or where there are two or more 8-ft layers. However, burners have been operated on a 10-ft fill which was placed directly in the swamp, and which settled to within a few feet of the lake surface.

5. Age of refuse. Burners have been operated in fills placed only 3 months before, and some gas has been obtained from a fill about 5 years old. However, most of the gas appears to be coming from refuse that is about ½ to 2 years old.

Observation indicates that unknown factors are also involved. For example, one day a particular burner may be receiving considerable gas and burning vigorously, yet the next day it cannot be ignited, although it may burn again at a later date.

It is believed that if a large swampy area is to be filled over a period of years, it is best to fill relatively smaller areas with several layers instead of covering the entire area first with one shallow layer. By this means more of the gas is trapped in the fill, and it is easier to maintain an adequate earth cover and to install burners over the smaller area of deeper refuse.

To summarize, daily covering of refuse with the recommended earth seal is the most effective method of reducing odors. However, the controlled burning of waste gas at the Union Bay site indicates that such burning offers the possibility of further reducing putrid odors. An analogy might be made with good fly control measures. The basic method of control is to remove breeding media, but chemicals are useful for supplemental control. Likewise, under certain conditions, controlled burning of waste gas may be useful as a supplement to good sanitary landfill operation.

Accompanying photographs were taken by E. F. Marten, Supervisor, Still Photo Unit, University of Washington, Seattle.

Mixed soils require five designs for ore dock reconstruction

Rebuilt dock wall at Lackawanna (N.Y.) Plant of Bethlehem Steel Company is result of ingenuity in design and construction. Ore storage area had to be kept in operation throughout the construction period.

E. M. CUMMINGS, M. ASCE

Sales Engineer, Bethlehem Steel Company, Bethlehem, Pa.

Rebuilding of a 4,000-ft ore dock near Buffalo, N. Y., was complicated by existing unstable structures, and the necessity for deepening the slip by 6 ft. It was also necessary to maintain the ore pile in continuous operation. Five different designs of sheetpile wall and ties were utilized to meet the varying conditions at the site of this dock of the Lackawanna Plant of the Bethlehem Steel Company.

The original dock was built about 54 years ago. It was poorly designed by modern standards and through the years gave a great deal of trouble. The original dock face was a rock-filled crib supporting a heavy concrete wall. This wall carries one of the two tracks on which the ore unloaders run, the other track being 73 ft further in. The gage and grade of these tracks must be kept constant, and the tracks must be kept straight. In the course of years the dock wall gradually moved out as much as 4 ft and settled about the same amount, carrying the outer track with it while the inner track was subjected to a much smaller movement. The result was continual expense and much difficulty in operation.

To accommodate larger ore ships, it became necessary in 1952 to deepen the slip alongside the dock by 6 ft. The problem then was to dredge down 6 ft beside a dock that was already on the verge of failure. Since ore is the basic material used by the steel plant, failure of the ore dock would immediately affect the operation of the plant.

Continuous plant operation maintained

The dock had to be kept in full operation during the navigation season, which extends from April through November. Thus its reconstruction had to be carried out between December and March. Since ore has to be reclaimed from storage every day of the year, only very limited areas could be made available at any time for construction of the necessary anchorages to tie back the top of the wall.

Another complication was that the original construction included a thin slab of concrete supported on wooden piles over a considerable part of the ore storage area. This slab and piles were entirely inadequate to support the ore surcharge of about 12,000 psf. The entire area was occupied by large fragments of concrete and broken piles, which had been pressed into the soft soil by the ore load. This made it impractical to support the ore load with piles, or to relieve the pore pressure with sand drains. However, neither of these methods would have been as economical as that adopted.

A profile of the soil conditions along the face of the ore dock is shown in Fig. 1. Note that the surface of the rock is very uneven, varying from about El. 500 to 548. The most serious problem was caused by a stratum of varved clay about 30 ft thick, which extends for a distance of 1,000 ft starting at the right side of the profile. This soil is of poor consistency, and it was in this region that the greatest movement of the old dock had occurred.

Because of the great variation in the rock surface, five different designs were required for economical reconstruction of the face of the dock, as previously mentioned. The five sections of dock in which these designs were used will be described, progressively from right to left in Fig. 1.

Section 1. This section extends for about 800 ft where the rock is at the greatest depth below the surface. Here a new Z-pile wall was already in place. However, because of the channel deepening from El. 550 to El. 544, it was necessary to reinforce this wall with 10 WF 100 beams. One beam was driven to good penetration in the hardpan in the "U" of each pair of piles. A plate was then welded over the top of the beam, connecting adjacent sheetpiles just above the water line. See Fig. 2 and a photograph.

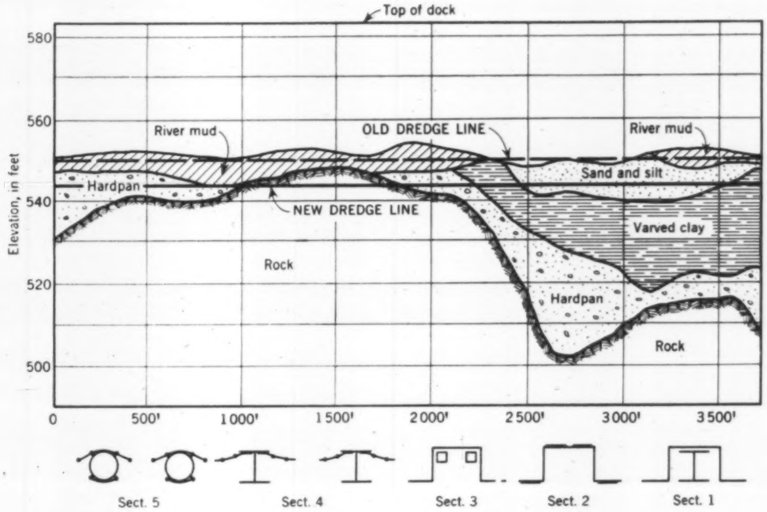

Top of dock
580
560
540
520
500
Elevation, in feet
River mud
OLD DREDGE LINE
River mud
Sand and silt
Hardpan
NEW DREDGE LINE
Varved clay
Rock
Hardpan
Rock
0
500'
1000'
1500'
2000'
2500'
3000'
3500'
Sect. 5
Sect. 4
Sect. 3
Sect. 2
Sect. 1

FIG. 1. Elevation of rock surface along dock wall varies from El. 500 to 548. Varved clay stratum at right presented most serious problem. To meet varying conditions, five types of wall design were used, as indicated along base of profile.

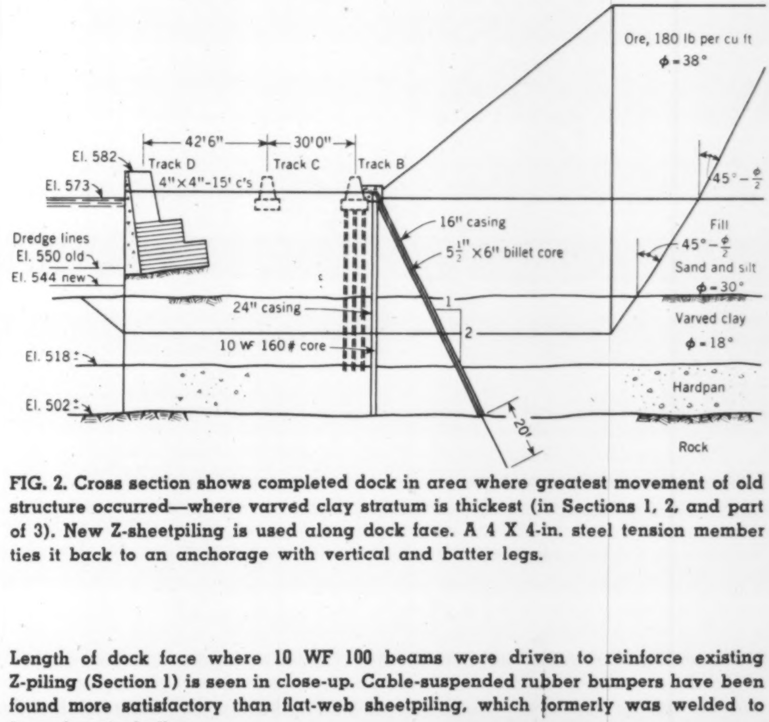

Ore, 180 lb per cu ft
$\phi = 38°$
42'6"
30'0"
El. 582
Track D
Track C
Track B
El. 573
4"×4"-15' c's
$45° - \frac{\phi}{2}$
16" casing
Fill
Dredge lines
El. 550 old
$5\frac{1}{2}$" ×6" billet core
$45° - \frac{\phi}{2}$
Sand and silt
El. 544 new
$\phi = 30°$
1
24" casing
Varved clay
2
$\phi = 18°$
10 WF 160# core
El. 518±
Hardpan
El. 502±
20'
Rock

FIG. 2. Cross section shows completed dock in area where greatest movement of old structure occurred—where varved clay stratum is thickest (in Sections 1, 2, and part of 3). New Z-sheetpiling is used along dock face. A 4 X 4-in. steel tension member ties it back to an anchorage with vertical and batter legs.

Section 2. In the next 550 ft, the heaviest Z-pile section was used, reinforced with 7½ × 1-in. plates riveted on the outside of the flanges. The plates doubled the section modulus.

Section 3. In the next 550 ft, a new Z-pile wall was already in place. This was considered adequate except that the new dredge depth did not permit enough penetration for bottom support. In this region, wherever the Z-piling could penetrate less than 11 ft before striking rock, a steel billet (4 in. × 4 in. × 7 ft long) was doweled into the rock for a distance of 3½ ft. These dowels were placed in holes of 6-in. diameter, drilled in the recesses of the Z-piling, and as close as possible to the piles.

Anchoring the wall

In the first two sections described above, and in part of the third, anchoring the top of the wall against movement was a difficult problem. The soil could not be depended on for suitable resistance as it had been pushing the dock out for years. Anchorage to rock was necessary in this area.

A cross section of the dock where the varved clay stratum is thickest, and where the greatest movement and settlement of the existing dock had occurred, is shown in Fig. 2. It was assumed that the existing dock had a

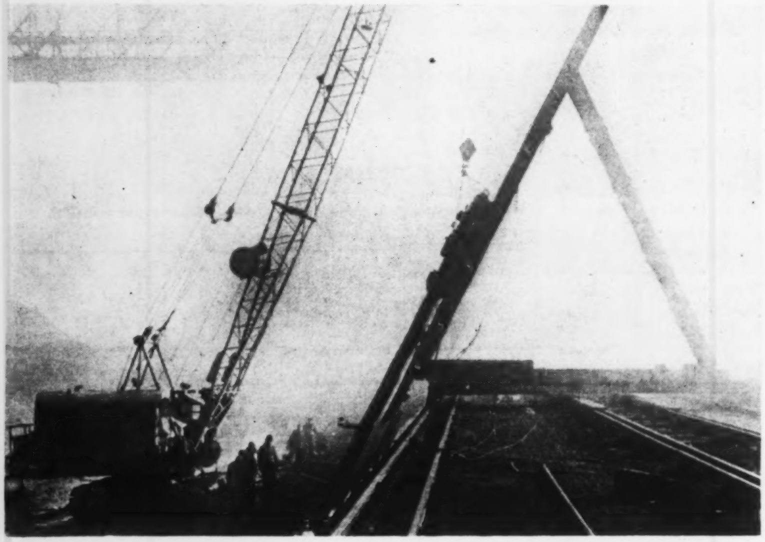
Length of dock face where 10 WF 100 beams were driven to reinforce existing Z-piling (Section 1) is seen in close-up. Cable-suspended rubber bumpers have been found more satisfactory than flat-web sheetpiling, which formerly was welded to face of vertical piles.

factor of safety of unity against failure. The resistance to sliding was determined by the "block-and-wedge" method. An angle of internal friction of 38 deg was assumed for the ore and 30 deg for the fill material above the varved clay. When an angle of 18 deg was assumed for the varved clay, the safety factor against sliding was unity.

The front wall was reinforced Z-piling, as previously mentioned, driven to rock as close as possible to the existing wall, which consisted of a rock-filled crib carrying a concrete wall 9 ft thick. A typical condition of the tilted dock is shown in Fig. 2. The space between the Z-piling and the existing structure was filled with concrete. Angle lugs were welded to the Z-piling to tie the old structure to the new and to help relieve the pressure of the old wall on the varved clay.

The anchorage was placed against the rear side of the "B" wall, which carried Track B for the ore unloaders and one of the ore-bridge tracks. See Fig. 2. The compression member of the anchorage is a 24-in. casing driven to rock and cleaned out. Then a 10 WF 100 core was set in it and the casing was filled with concrete.

The tension member is a 16-in. casing driven to rock on a slope of 2 vertical on 1 horizontal, with a 5½-in. × 6-in. billet core, which extends 20 ft into rock. To start the drill bit of 12¾-in. diameter into the rock on a slope, it was necessary to place concrete in the pipe at the rock surface and drill through it. The core had welded-on lugs, and the hole in the rock was filled with Embeco concrete, which expanded when it set, thus providing tight contact with the rock.



Frame, riding on ore-unloader tracks, guides driving of anchorage casing of 16-in. diameter.

One anchorage was tested with 300-kip force. Tension member is designed for 606 kips and compression member for 540 kips, with tie-rod pull of 270 kips. In test, only one quarter of 20-ft depth of anchor in rock was filled with concrete so that test represented 100-percent overload on grip of rock on 5½ X 6-in. billet.

Along the rest of the dock, anchorage for the top of the wall was obtained by ties to a line of ZP 38 sheetpiling 80 ft from the face of the dock.

Section 4. In the length of 1,150 ft where the existing rock surface was higher than the required dredge depth, beam master-piles were driven on 7-ft 6-in. centers and keyed into the rock, with connecting arcs of SP-6a (flat-web) sheetpiles.

The master-pile design required that a casing of 24-in. diameter be driven to rock and the soil blown out. Next a hole of 22-in. diameter was drilled into the rock inside the casing to El. 541, 3 ft below the future dredge line. At the center of this hole, a 6-in. hole was drilled 4 ft further into the rock. The beam master-pile is a 14 BP 89 with part of a sheetpile riveted to the flanges, as shown in Fig. 3. A 5½-in. dowel is welded into the bottom of the beam master-pile. The beam was lowered through the casing and into the 22-in. hole. The dowel fitted into the 6-in. hole. The casing was then pulled.

Beam piles were connected with arcs of five sheetpiles each. Sheetpiles were 15 in. wide. They were driven to the original rock surface, which was as much as 4 ft above the new dredge line.

The master piles were tied back to the old concrete wall, and new concrete was placed in the space between the sheetpiling and the old wall. On top of the sheetpiling a massive reinforced concrete beam was cast in place and tied back to a wall of Z-piling, using 2¾-in. tie rods spaced 14 ft 10 in. on centers.

To blast the rock in the slip to the new dredge depth, the rock was first line-drilled along the edge of the dock, between the master piles, using holes of 6-in. diameter spaced 1 ft on centers. Blasting holes were drilled about 4 ft out from this line. When the blasts were set off, the rock broke off along the line-drilled holes. See Fig. 3.

Section 5. In the last section of the dock, the existing rock elevation was a few feet below the new dredge line, but not sufficiently below to provide an adequate toehold for the sheetpiling. A master-pile design was again adopted, this time using pipe of 20-in. diameter and ½-in. wall thickness. A sheetpile, bent to the pipe radius, was welded to each side of the pipe.

The inside sheetpile serves as the connection for arcs of 22-ft radius made up of nine sheetpiles spanning between the master piles. The outside sheetpile serves as a cover plate to make the pipe section symmetrical, and thus builds up the section modulus. The pipe, with sheetpiles attached, was driven to rock and cleaned out. Then inside it a 6-in. hole was drilled 4 ft into rock. A pin of 5½-in. diameter was fitted into the hole and extended 4 ft up into the pipe, where it was held by tremied concrete which filled the pipe.

Space between the master piles and the old wall was filled with concrete. A heavy reinforced concrete wall was poured on top of the sheetpiling and tied back to the sheetpile anchorage.

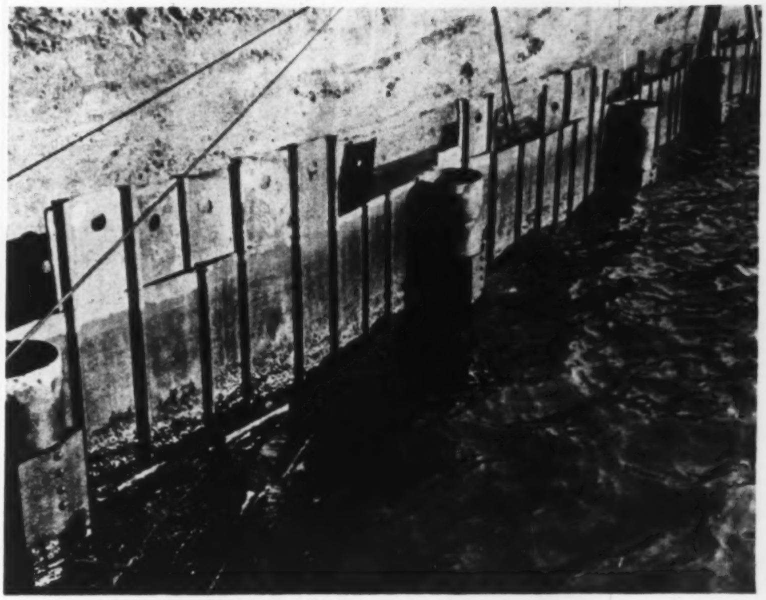
Movement carefully measured

To permit accurate measurement of movement in the area, three markers were established. Each was installed by driving a pipe of 16-in. diameter to rock, cleaning it out, and inside it drilling a 14-in. socket 4 ft into the rock. A 6-in. pipe was set plumb in this socket, and around it the socket was filled with concrete. A marker plate was then set on top of the 6-in. pipe. The 16-in. pipe, above rock, was allowed to fill with water. With this arrangement, displacement of the soil would move the 16-in. pipe, but the inner pipe would remain plumb.

Rebuilding of this ore dock was carried out in 1952 and the early spring of 1953. Measurements taken since its completion show that movement has been slight and well within the limitations of elasticity of the tie rods and anchorages. All five designs used for the dock face have proved satisfactory.

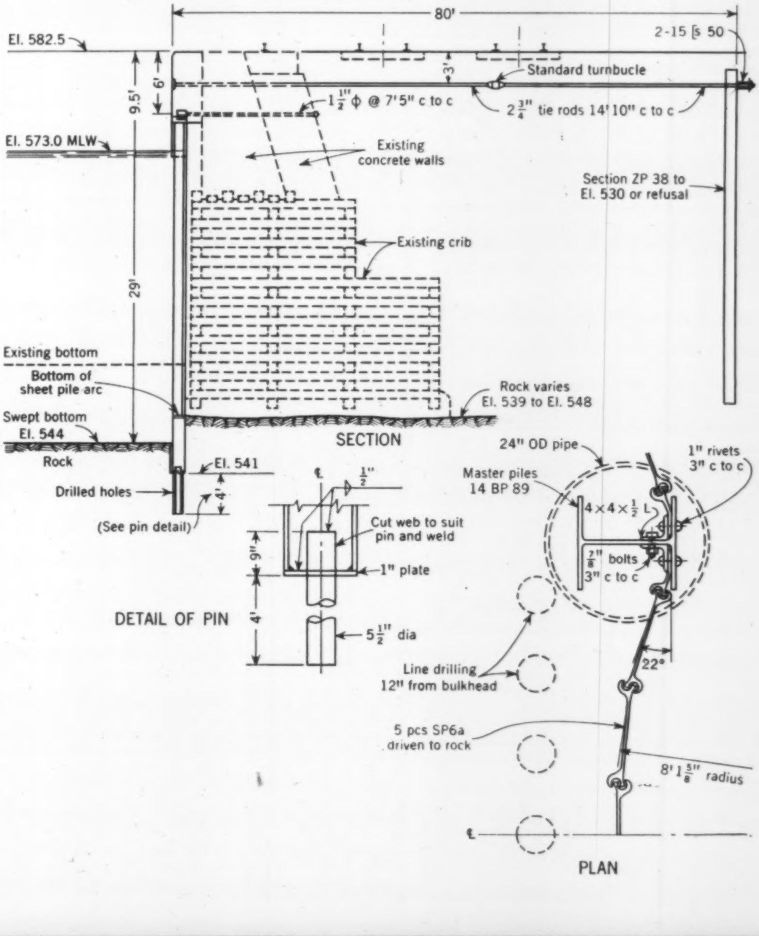
Final design of the reconstructed dock was under the supervision of L. G. Gould, Chief Engineer of Construction, Bethlehem Steel Company, and the writer. Construction was supervised by F. S. Eckhardt, Chief Engineer, Lackawanna Plant. Preliminary studies were made by Moran, Proctor, Freeman and Meuser, New York, and by Western Foundation Company, New York. Contractor for the work was the Merritt, Chapman Scott Corporation of New York.

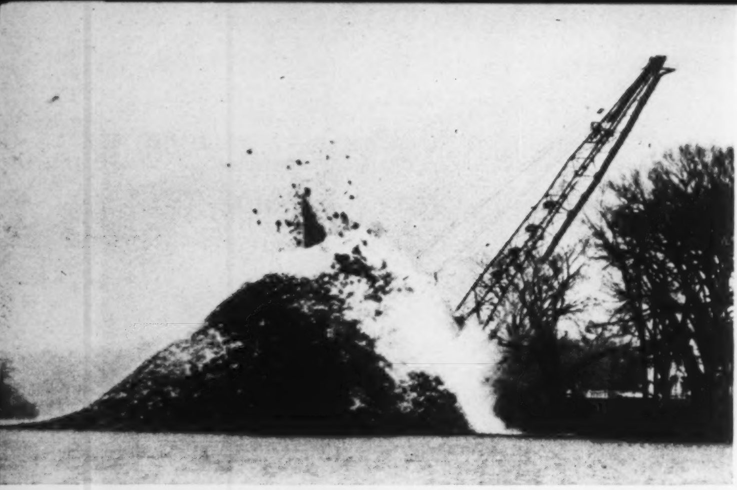
(This article has been condensed from the paper presented by Mr. Cummings at the ASCE Buffalo Convention, before a Construction Division session presided over by Warren N. Riker, Vice Chairman of the Division's Executive Committee.)



Pipe master-piles were driven on 12½-ft centers and doweled into rock to strengthen dock where sheetpiling has limited toehold—referred to as Section 5.

FIG. 3. Where rock surface is above final dredge depth, beam master-piles with connecting sheetpile arcs are used—referred to as Section 4.


80'
El. 582.5
2-15 [s 50
3'
Standard turnbucle
6'
9.5'
1½" ϕ @ 7'5" c to c
2¾" tie rods 14'10" c to c
El. 573.0 MLW
Existing concrete walls
Section ZP 38 to El. 530 or refusal
Existing crib
29'
Existing bottom
Bottom of sheet pile arc
Rock varies El. 539 to El. 548
Swept bottom El. 544
Rock
SECTION
El. 541
4'
Drilled holes
(See pin detail)
℄
½"
Cut web to suit pin and weld
9"
1" plate
DETAIL OF PIN
4'
5½" dia
24" OD pipe
1" rivets 3" c to c
Master piles 14 BP 89
4×4×½ L
⅞" bolts 3" c to c
22°
Line drilling 12" from bulkhead
5 pcs SP6a driven to rock
8'1⅝" radius
℄
PLAN



At peak of blast on shoal No. 54, amount of flying rock is small, and what there is heads for mid-channel, away from structures on the island.

JOHN L. ROMIG

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ON-SHORE DRILLING for blasting of underwater shoals

Drilling and blasting from dry land in order to excavate an underwater shoal may sound like doing things the hard way, but it is actually speeding the completion of Stage 1 of the Thousand Islands Channel Improvement project. The contract, undertaken by the Tecon Corporation of Dallas, Tex., calls for the removal of 37 shoals from the St. Lawrence River between Clayton and Alexandria Bay, N. Y. When completed later this year, the 11½-mile channel, 450 to 600 ft wide and 29.5 ft deep at low water, will be a link in the St. Lawrence Seaway providing access to the Great Lakes for ocean-going ships.

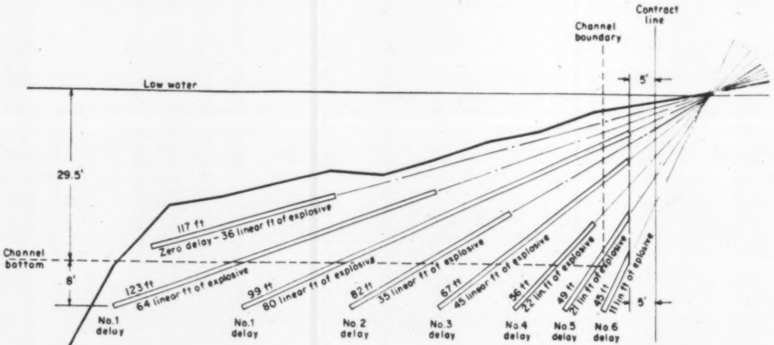
Of the 37 shoals, four consisted of massive hard red granite jutting into the new channel from adjacent islands. It was these projecting rock shoals that were drilled and blasted from dry land. Thus the necessity of maneuvering a heavy drilling boat in the difficult shallow waters bordering the islands was eliminated, and the four shoals were removed much more quickly and efficiently than they could have been by conventional under-water drilling and shooting methods.

The technique required drilling a number of holes at various angles, but in the same vertical plane, from a point on the rock located inshore from the channel boundary. Each hole had to be drilled at a different, carefully predetermined angle from the horizontal, out through the underwater section of the rock for a specific, predetermined length. The resulting "row" of holes made a fan-shaped pattern, consisting of holes diverging from each other as they reached out, like spreading fingers, under the rock projection (see Fig. 1).

Success lay in careful planning by Tecon engineers under the direction of L. F. Ramer, the project manager who conceived the scheme. The profile of the shoal at each station where a "row" of holes was to be located was carefully determined and plotted. Then each hole was laid out on paper and its explosive charge determined according to the following criteria.

Holes of 3-in. diameter were planned so that the burden on each would never exceed 8 ft, and so that each hole projecting beneath the final elevation of the channel bottom would be 8 ft below that elevation. Location of the explosive in each hole was plotted allowing 4 lb of dynamite per

FIG. 1. Cross-section profile shows vertical, fan-shaped pattern used for on-shore drilling to remove massive red granite in shoal No. 54. Millisecond delay initiation provides relief for each hole.


Contract line
Channel boundary
5'
Low water
29.5'
Channel bottom
8'
117 ft
Zero delay - 36 linear ft of explosive
123 ft
64 linear ft of explosive
No.1 delay
99 ft
80 linear ft of explosive
No.1 delay
82 ft
35 linear ft of explosive
No 2 delay
67 ft
45 linear ft of explosive
No.3 delay
56 ft
22 lin ft of explosive
No.4 delay
49 ft
21 lin ft of explosive
No.5 delay
45 ft
11 lin ft of explosive
No.6 delay
5'
Contract line

lin ft of hole. No dynamite was loaded closer than 5 ft to the contract line. This loading plan provided about ½ cu yd of rock per pound of explosive. These vertical "rows" were spaced at 8-ft intervals along the length of the shoal.

Millisecond delay pattern

As shown in Fig. 1, millisecond delay initiation was used to provide relief for each hole, progressing from the free face toward shore. A similar progressive pattern extended the length of the shoal as shown in the schematic delay pattern in Fig. 2. Millisecond delay electric blasting caps were used not only to free "tight" holes but to provide maximum fragmentation, reduce ground vibration, and direct throw toward mid-channel, away from structures on the island. The two latter considerations were extremely important because the Thousand Islands are highly developed as a summer resort area, and although sparsely populated at the time this work was in progress, they contain many large summer homes.

The fan-shaped hole pattern for shoal No. 54 at Station 24 + 78 is shown in the cross-section profile, Fig. 1. Eight holes were loaded with 134 lin ft of Atlas Giant gelatin dynamite. The outermost hole was primed with an Atlas Rockmaster zero delay cap and the other holes were primed with caps having progressively longer delay periods.

A schematic layout of the entire shot is given in Fig. 2 to illustrate the millisecond delay pattern. This shot consisted of eight fan-shaped vertical "rows" of holes spaced 8 ft apart. The number of holes per row varied from 7 to 9, and the 67 holes in the shot contained a total 8,017 lb of Atlas Giant gelatin dynamite. The longest hole extended 140 ft into the shoal. The farthest inshore hole in some rows was drilled 5 ft from the contract line to insure a clean break at the edge of the channel.

The holes were drilled from the shore with a Gardner Denver 123 M Air-Trac and a Joy TM 450 track-mounted drill, powered by two Gardner Denver air compressors (600 and 900 cfm). Careful drilling control produced 3-in. holes at the desired angle and depth. After completion, but before loading, each hole was plugged and tagged for positive identification.

Four days were expended loading the shot with a predetermined quantity of explosive in each hole. Atlas 60- and 75-percent Giant gelatin was selected for its water resistance as well as its shattering high velocity. The 2½ x 16-in. cartridges were slit before loading and tamped tightly to attain the desired powder density. A sectional aluminum tamping pole with quick-coupling 10-ft sections greatly facilitated loading. Each charge was primed near the bottom of the hole with the Atlas Rockmaster millisecond delay electric blasting cap called for in the plan. Several holes crossed fissures in the rock, which allowed the entrance of river water. These were loaded through liners of flexible aluminum tubing with an outside diameter of 2¾ in.

After each hole was loaded and checked, it was tested electrically before being connected into the series-parallel blasting circuit. When the circuit had been connected into the leading wire, the shot was fired with a condenser-discharge type of blasting machine.

A well broken, easily dug muck pile was the result of the shot on shoal No. 54. The shot pulled cleanly to both depth and width. Rock throw was limited and definitely directed into the channel. Because of the progressive millisecond delay detonation, which broke the large shot into a series of much smaller blasts, no harmful vibrations were recorded by the three seismographs set up nearby. Despite the nature of the solid rock terrain and the presence of a large body of water, the amplitude of the vibrations recorded did not exceed 50 percent of that considered dangerous to structures.

The remains of shoal No. 54 were cleared from the channel by a Monhegan 7 W equipped with a 6-cu yd dipper dragline. The dragline cast the spoil into selected deep areas of the channel, where the depth often exceeds 200 ft and where fill is permitted up to a depth of 50 ft below low water. Short lengths of bore holes remaining in the rock inshore from the excavation were plugged with grout.

Underwater blasting and clearing

For the 33 shoals in mid-channel, conventional underwater drilling and blasting techniques are used. Tecon has built a 134-ft drill boat carrying three 710-cfm Joy stationary compressors powering three TM 500 Joy drill rigs. The drills are cantilever-mounted for four-way travel. They move out and back from the boat on the cantilevers while the cantilevers move both ways laterally. The standard underwater drilling pattern calls for 4½-in. holes on 8 x 8-ft spacing. A typical pattern might be 4 holes wide and 13 holes long, with all holes drilled 8 ft below the final elevation.

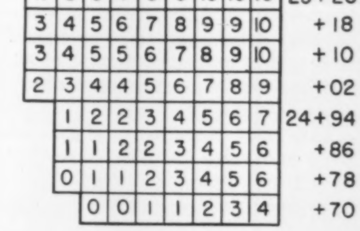
In a normal rectangular pattern, each row is detonated with Atlas Rockmaster caps of the same delay period. The shorter delay caps are used in the holes nearest the free face of the rock, with progressively longer delays in each row going back into the rock. Atlas Giant High-Velocity gelatin in 2½ x 16-in. sticks is loaded and tamped through brass loading tubes. Cap leg-wire connections are waterproofed and the shots are fired with a condenser-discharge type of blasting machine.

The millisecond delay caps reduce the hazard of propagation of detonation from hole to hole and hold the vibration to a minimum while providing excellent fragmentation.

Blasted underwater shoals are dug with a barge-mounted 88 B Bucyrus Erie 4-cu yd drag or clam bucket. The spoil is either cast into deeper water or loaded on flat scows to be carried to designated dump areas. Spoil is pushed from the scows by an Allis Chalmers HD 15 dozer.

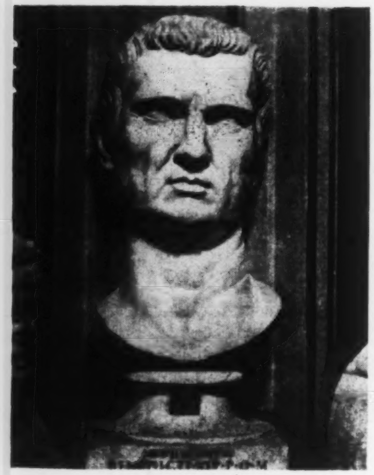
Removal of all 37 shoals calls for the excavation of 210,000 cu yd of red granite from the channel. The overall powder factor is expected to be 2½ lb of explosive per cu yd.

Stage 1 of the Thousand Islands Channel Improvement project is being performed under the supervision of the Buffalo District, U. S. Army Corps of Engineers. L. F. Ramer was project manager for Tecon Corporation at the time the drilling and shooting methods were developed. Harvey Hancock is the current project manager. It was the privilege of the writer (a member of AIME) to assist in blast planning and execution with the help of Atlas Powder Company's field representative James E. Dedman, Jr.



4	5	6	7	8	9	10	10	10	25+26
3	4	5	6	7	8	9	9	10	+18
3	4	5	5	6	7	8	9	10	+10
2	3	4	4	5	6	7	8	9	+02
	1	2	2	3	4	5	6	7	24+94
	1	1	2	2	3	4	5	6	+86
	0	1	1	2	3	4	5	6	+78
		0	0	1	1	2	3	4	+70

FIG. 2. In schematic delay pattern for shoal No. 54, delays progress from free face toward shore and progressively from upstream end of shoal toward downstream end. Numbers refer to Atlas Rockmaster millisecond delay period.



Marcus Vipsanius Agrippa (63-12 B.C.), right-hand man and close friend of Emperor Augustus, was an exceptional military commander, administrator, initiator and director of public works. He pioneered in the efforts of the Empire to bring "the rule of peace to vanquished foes," notably in planning and supervising such provincial public works as the Pont du Gard in south of France.

The Engineer through the Ages

The Architectus of the Roman Empire—Part 2

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Columbia University, New York, N. Y.

The Golden Age of Augustus represents the high-water mark in Roman engineering achievement. Not only was the Emperor engaged in economic and administrative reforms, he also initiated extensive construction projects both at home and in France and Spain in the course of his 45-year reign. Assisting in these undertakings, he had as his right-hand man, his close friend and trusted associate Marcus Vipsanius Agrippa (63-12 B.C.). Of obscure origin, Agrippa was an exceptionally gifted military commander, an organizer and administrator of outstanding abilities, and a public servant of the highest type.

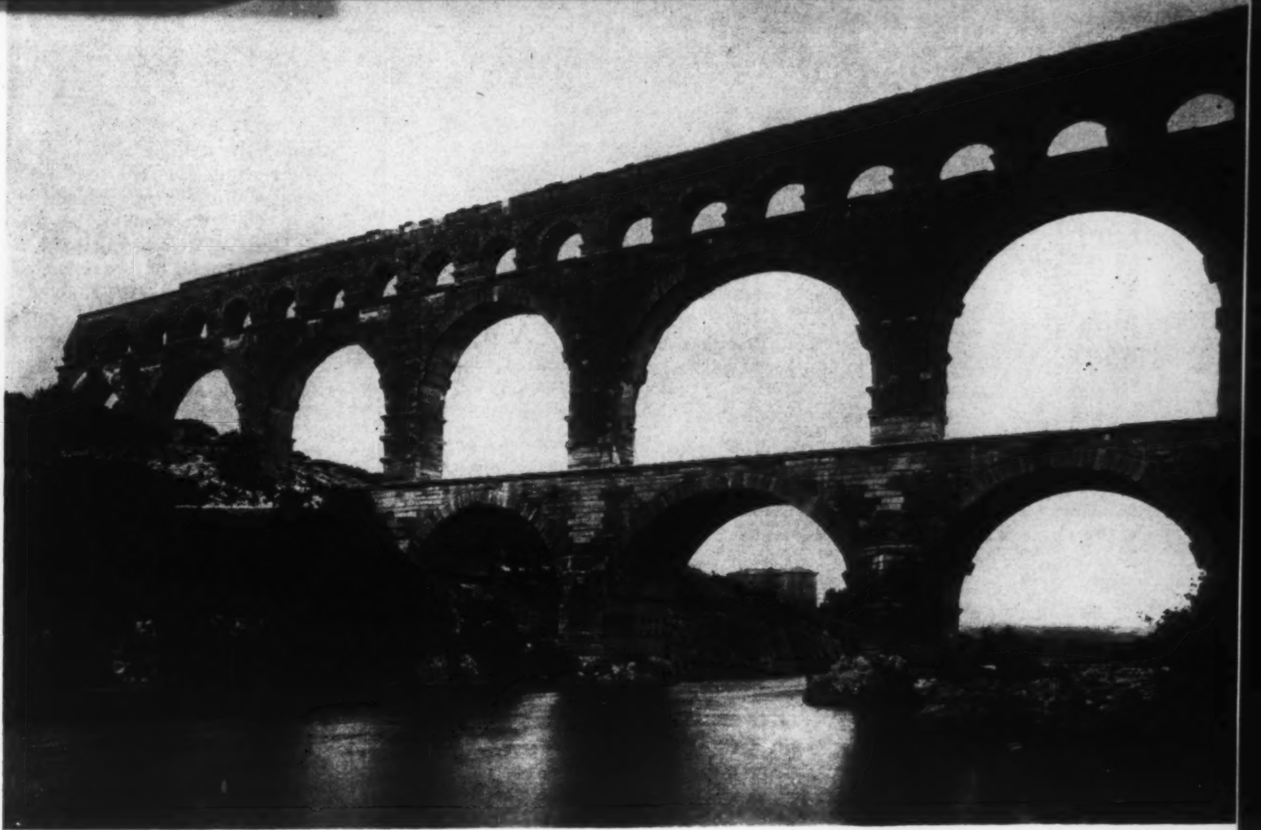
Two new aqueducts, Julia (33 B.C.) and Virgo (20 B.C.), were built for Rome under the direction of Agrippa on the Campus Martius. Neither was outstanding in size or design. The great circular dome-covered Pantheon at Rome also bears Agrippa's name although it was probably rebuilt by the Emperor Hadrian.

From the engineering standpoint the most outstanding work associated with Agrippa is the justly famous Pont du Gard in southern France. Agrippa had gone to Transalpine Gaul (France) in 19 B.C. to organize and consolidate Roman holdings. According to Strabo, the Greek-Roman geographer of the period, Agrippa selected Lugdunum (Lyons) at the junction of the Saône and Rhône as the capitol city. Four great roads with many later branches extended to the borders of the country and on these roads several remarkable bridges were built, among them the 17 arches of the Pont du Sommières, of which seven still stand.

Nîmes and other cities in southern France are also rich in Roman remains, representing the first great accomplishments of Roman engineering outside the Italian peninsula. Many such works both in France and Spain are attributed to the Age of Augustus and there seems little doubt that Agrippa directed and supervised the building of the Pont du Gard.

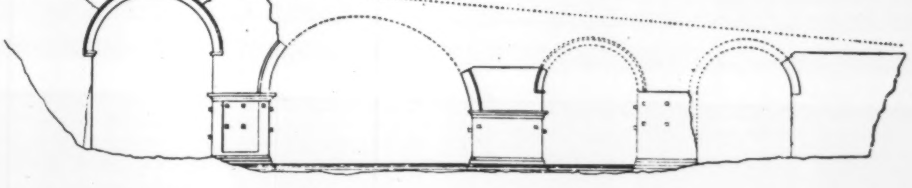
This great structure, 150 ft high, with massive piers and arches, was part of a 24-mile aqueduct bringing water from a source near Uzes to the Roman city of Nîmes. One of the best preserved of Roman works, great in scale, standing in solemn grandeur in a relatively uninhabited bit of country remote from the current of modern life, it cannot fail to give the visitor a deep respect for its builders.

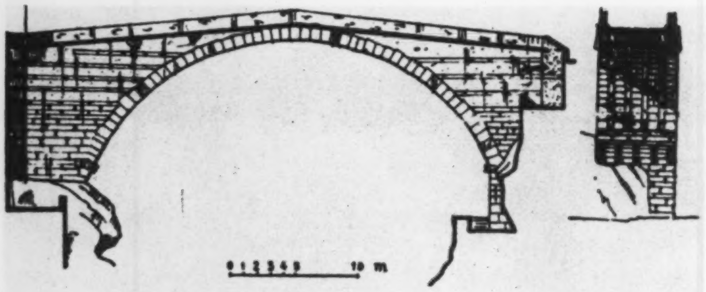
The work is in three levels, decreasing in width as they go up. The six



Imposing monument to Roman engineering skill is Pont du Gard, probably built about beginning of Christian Era under direction of Agrippa. This massive structure, part of ancient water supply of Nimes in south of France, is well preserved. All of dry masonry except for "specus" or water channel on top, it has height of 150 ft, and the larger arches have a span of 74 ft.

Only end arch remains of bridge at Narni, Italy, built under Augustus. Main arch of this imposing work had span of a bit over 100 ft, one of longest spans attempted by the Romans. Reconstructed drawing, shown below, is from Choisy's "L'Art de batir chez les Romains," Paris. 1876.





Single great arch of 103-ft span, known as Ponte San Martino, is in remote St. Bernard Pass area on border of Switzerland. Note unusual arrangement of five separate arch rings with rubble concrete filling between.

bottom arches, of 50- to 74-ft span, are 20 ft wide. Arches of the next tier have the same spans but are only 15 ft wide, while the third series of arches, of uniform 16-ft span, are 10 ft wide. At the top is the covered water conduit, or *specus*, 4 ft wide and 6 ft high. It is the only part of the work in which cement was used. All the rest is "dry" masonry.

Several interesting Roman practices can be observed in the Pont du Gard. The surface of the stone was never dressed. At intervals, binding stones, or headers, project beyond the face, presumably used as aids in the support of scaffolding. Pockets left in the inner faces of the piers and the soffits of the larger arches were apparently used for the same purpose. Two courses of the lower ring stones were left projecting beyond the arch intrados, apparently to support the arch centering. Finally, the larger arch rings were built as separate adjacent rings, four in the lower and three in the second tier, that is, without any headers in "the coursing joints." It is surmised that this plan was used to permit one set of timber arch centering to be moved laterally and used successively to complete each ring. A similar plan was followed in the nearby Roman bridge at Sommières and in the arched passageways of the Roman arena at Arles. It was copied in the medieval bridge (1177) at nearby Avignon. The side roadway bridge at the first level of the Pont du Gard was added in 1747.

When we recall that the function of this huge structure was simply to support the water conduit at grade, the limitations imposed by available materials become clear. Metal for pressure pipes was lacking. An aqueduct bridge was the only practicable answer. However, the obvious "overdesign" of the Pont du Gard was not repeated in the later, almost skeleton-like construction of the Aqueduct of Segovia in Spain.

Some of the basic characteristics of the Pont du Gard are echoed in another famous Roman bridge, that at Narni, also attributed to the reign of Augustus. Spanning the Nera River on the Flaminian Way some 60 miles north of Rome, the remains of this structure exhibit the same monumental characteristics as the Pont du Gard. Narni poses some interesting though unanswerable questions. The roadway was clearly very steeply inclined, on a grade we would regard as excessive. The main arch, generally considered to have been the longest span built by the Romans, was destroyed in a great flood in 1304. The massive piers, 33 ft wide, had no cutwaters and therefore interposed a major barrier to stream flow.

Today only a pile of fallen stone marks the east end of the longest span, and we must rely on measurements taken in 1862 when, apparently, much of the pier and part of the arch ring were still in place. Choisy (*L'Art de batir chez les Romains*, Paris, 1876) shows the span as 102 ft, but he also reports an extraordinary and apparently unnecessary feature in the lowered springing line on the east pier. Presumably this would indicate a two-centered circular arch, a type unique in Roman construction. Narni is also notable in that the end arch was constructed with five distinct projecting arch rings instead of the smooth arch barrel, or soffit, generally used in Roman work. This great bridge, estimated to have had a maximum height of 115 ft, thus apparently incorporated some interesting innovations in Roman bridge practice of which time has stolen the details.

Another bridge, a single great arch known as Ponte San Martino, is reported to be a Roman work. (See *Il ponte murario Romano* by Giuseppe Albenga, *L'ingegnere*, Milan, Oct. 1939 p. 869.) Located in the remote Alpe Graia of the St. Bernard Pass area on the border of Switzerland, it is well preserved. The span is about the same as that of Narni, 103 ft, but the unusual construction, five separate arch rings with a filling of rubble concrete between, and a similar filling between the horizontal stone courses in the spandrels, would seem to indicate that the reported date, 120 B.C., is too early. This bridge also may have been a work of the late Republic or early Empire.

These new forms of construction were reflected in the purely architectural works of the period. It has been remarked that the boast of Augustus, that he found Rome a city of brick and left it a city of marble, should be revised to read "a city of brick with marble facing." The vaulted buildings of the day show the use of brick ribs with lighter concrete filling, reducing, it has been argued, the loads to be supported, but clearly also simplifying the construction and permitting the use of labor less skilled than that required for cut-stone work. In short, these new construction methods and materials not only were less costly but also were designed to reduce unemployment by utilizing new labor sources—displaced farm hands, immigrants from the provinces, and soldiers returning from the wars. This increasing unemployment apparently made it necessary to provide a public works program geared to the capacities of unskilled workers—a situation that reminds us of the efforts of our own "New Deal" in the 1930's.

There were of course exceptions. The use of skew arches proves that the Romans did not hesitate to face the more complicated problems of stone cutting and fitting where the situation dictated the use of this more difficult form. Among the many other bridges attributed to Augustus is the skew structure at Rimini on the north Adriatic coast, the so-called Ponte di Augusto. This bridge of five spans, 24 to 29 ft long, has heavy piers 13 ft wide. A skew alignment was also used for the arched passageways of some Roman amphitheaters, such as that at Nîmes. Although brick and concrete continued to play a major role throughout later Roman work, notable structures also show a return to the solid stone construction of earlier days.

(Subsequent articles will continue the story of engineering construction during the Roman Empire.)

In the October issue, the authors reported on the results of their examination of 47 buildings in Mexico City after the earthquake of July 28, 1957, in the area of greatest shock intensity. The reader is referred to that article for the location and detailed description of the buildings examined. In the present article the authors classify these structures according to type of foundation and superstructure, discuss causes of failure, and present their personal views on the design and construction of earthquake resistant buildings in Mexico City.

Earthquake resistant construction in Mexico City

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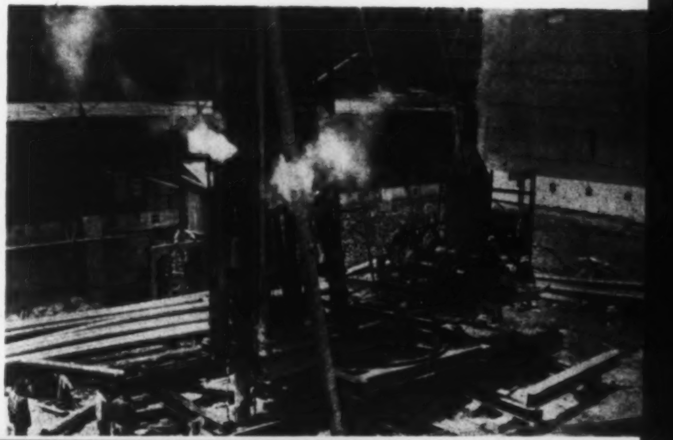
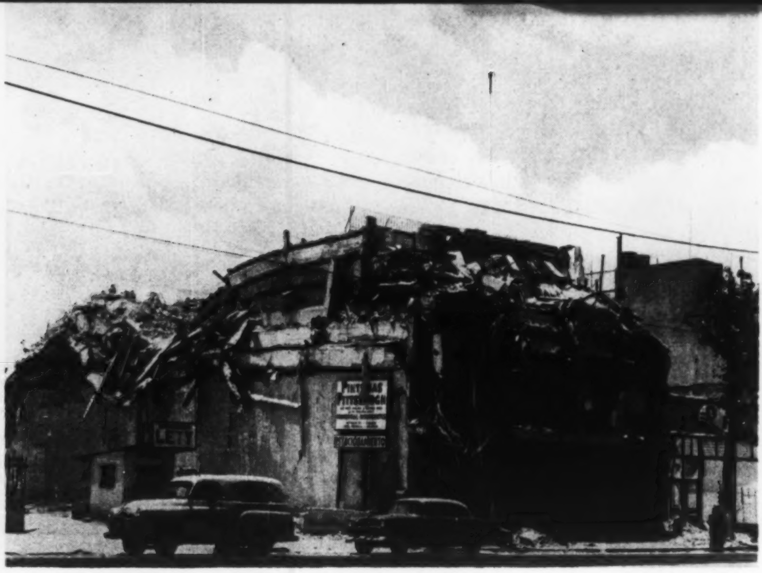
PEDRO ALBIN, Jr., A.M. ASCE Vice-President, Cimentaciones Mexicanas, S. A., City of Mexico, D. F.

To be of any practical purpose, the goal of earthquake resistant design must be kept within the limits of the economic value of the structure. It is no more realistic to seek a design that will withstand the maximum possible

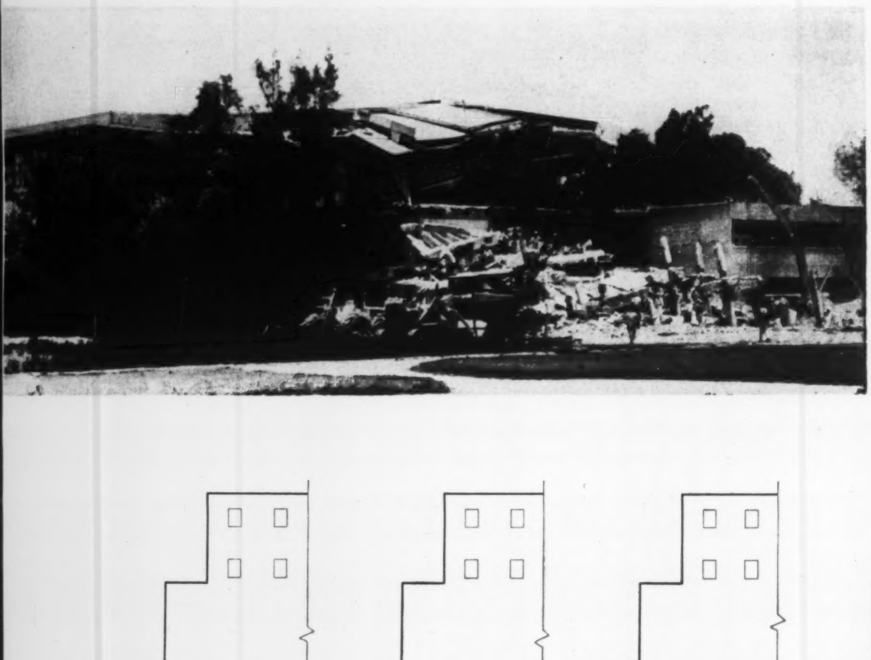


Tallest skyscraper south of U. S. border (top photo) came through quake unscathed. Torre Latino Americana, recently completed, is a 43-story steel-frame office building which rests on concrete piles extending down 102 ft to cemented sand stratum. At right, casing has just been driven for cast-in-place ButtonBottom pile for this building. Spiral pile shell, to be filled with concrete, is being lifted for lowering inside casing, which will then be withdrawn.



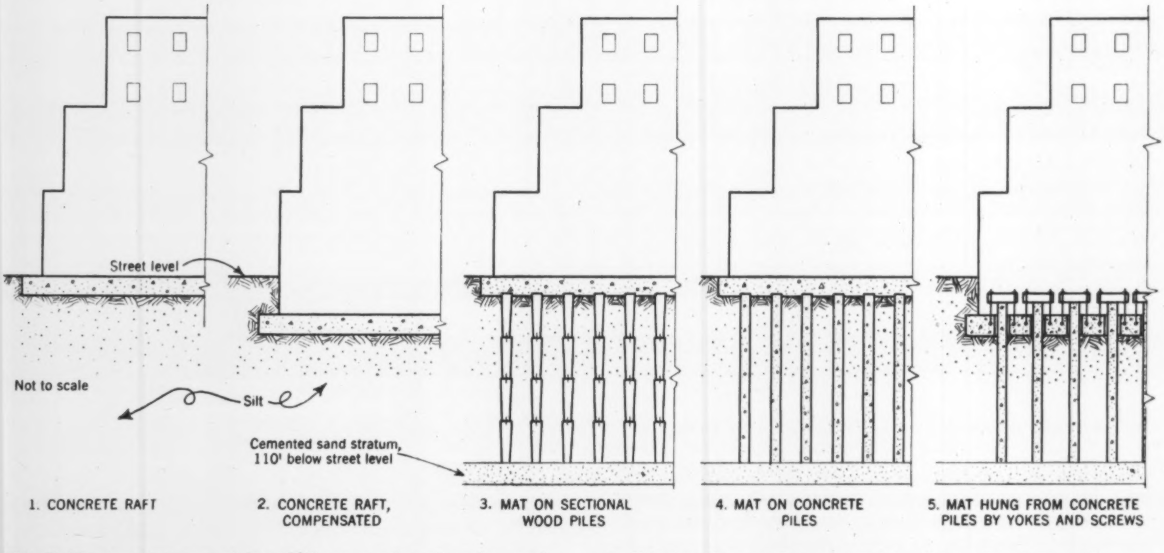
Reinforced concrete office building six stories high was eight years old at time of quake. This structure, at Insurgentes 337, rests on a concrete-raft foundation. Five upper floors collapsed, leaving building a complete wreck.

Buildings of Polytechnical School were among most complete wrecks left by earthquake.



earthquake intensity without so much as a shattered window than it would be to attempt to build a structure to withstand the direct hit of an H-bomb.

Even with so wide a variety of full-scale structures at hand for study, we obviously cannot expect to find all possible combinations of the most important factors. We have lined up the facts as objectively as possible on 47 of the buildings over 6 stories in height, both damaged and undamaged by the quake, and in this article will offer certain suggestions as to future structural procedures which in our opinion seem to be plainly indicated by the evidence.



1. CONCRETE RAFT
2. CONCRETE RAFT, COMPENSATED
3. MAT ON SECTIONAL WOOD PILES
4. MAT ON CONCRETE PILES
5. MAT HUNG FROM CONCRETE PILES BY YOKES AND SCREWS

FIG. 2. Five main types of foundations are found under modern buildings in Mexico City. Fig. 1, showing locations of buildings discussed, appeared in the authors' preceding article (October 1957, p. 78).

Typical earthquake damage is seen in curtain wall of 13-story office building of reinforced concrete (Edificeo Immobiliaria America).

As previously pointed out, the quake of July 28 has opened up a unique opportunity for the study of earthquake damage, not on the basis of theory and assumption but on that of actual observable results. This is true because:

1. The area of maximum damage is limited.
2. This same area contains by far the larger part of the city's modern structures.
3. The soil conditions throughout this area, while not identical, are unusually similar. The sand stratum to which practically all the deeper foundations are carried is to be found everywhere in this area at or near the same depth of 110 ft.
4. The superstructures of the buildings in the area represent most of the basic designs in modern use: steel frame with reinforced concrete floors; reinforced concrete throughout; and reinforced concrete frame with brick or block curtain walls.
5. The foundations cover an equally wide field, as shown in Fig. 2. They consist of plain concrete rafts; compensated rafts; pile-supported, rigidly connected mats resting on sectionalized wood piles; similar mats resting on precast or cast-in-place concrete piles; or pierced mats hung on piles.

At points outside this "laboratory" area, there are isolated modern structures under which the soil profile varies widely from that found within the area. Damage is mostly moderate to minor in these outlying areas.

The intensity of the shock—in the range of Mercalli 7½—was sufficiently severe to cause major damage but not severe enough to bury the information where the engineer and scientist could never find it. There have been many minor quakes in Mexico in the recent past but they taught little or nothing. On the other hand, if the quake had been substantially more violent than it was, there might have been but little to study. A heap of rubble makes a poor textbook.

Most of the structural studies of the Mexico City disaster seen by the writers concentrate on the superstructure design. While poor materials and poor workmanship come in for a share of the blame, as they should, it is our observation that a surprisingly small percentage of the damage can be blamed on poor quality of concrete in the main structural members. There is no indication of failure of structural steel or reinforcing bars as such. In a number of instances, the presence of disintegrated and honeycombed concrete at the junction of beams and columns might have been an important cause of partial failure.

In Tables I, II, and III, these 47 buildings are classified on three different bases, that is, according to foundation, type of structural frame, and height respectively. The effect of foundation type on the stability of the building against shock is shown with surprising clarity and uniformity. It is difficult to see any definite trend in the classification by type of structural frame or in that by height of building.

The most important single factor in the design of an earthquake resistant structure, in Mexico City and in many other locations, is the foundation. The shock of an earthquake must be transmitted to any structure by the soil in or on which it develops its bearing. A key factor that is within the control of the designer is the stabilization of

TABLE I. Buildings classified according to foundation

Foundation Type	Not Damaged	Damaged	Total
1. Concrete mat, plain	2	5	7
2. Concrete mat, compensated	0	8	8
3. Mat supported by sectional wood piles	3	12	15
4. Mat supported by long concrete piles	6	0	6
5. Pierced mat, hung from piles by yokes and adjustable screws	1	9	10
6. Not classified	0	1	1
Totals	12	35	47

TABLE II. Buildings classified according to structural type

Structural Type	Not Damaged	Damaged	Total
Steel frame with reinforced concrete floors	4	6	10
Reinforced concrete frame, floors and walls	9	20	29
Reinforced concrete frame, with brick or block curtain walls	0	7	7
Shell roof	0	1	1
Totals	13	34	47

TABLE III. Buildings classified according to height

Height	Not Damaged	Damaged	Total
1 story	0	1	1
4 stories	0	1	1
5 stories	0	4	4
6 stories	0	1	1
7 stories	2	1	3
8 stories	1	3	4
9 stories	3	2	5
10 stories	2	2	4
11 stories	0	3	3
12 stories	1	3	4
13 stories	0	5	5
14 stories	0	2	2
15 stories	0	1	1
16 stories	0	2	2
18 stories	1	1	2
23 stories	1	0	1
43 stories	1	0	1
60 ft	0	1	1
80 ft	0	1	1
130 ft	0	1	1
Totals	12	35	47

the foundation of a building. The shock may be dampened or it may actually be increased by the foundation before it is delivered to the superstructure.

The five types of foundation in general use in Mexico City are illustrated in Fig. 2. The rafts generally used in Types 1 and 2 are similar, being pocketed or honeycombed to reduce their dead weight to a minimum. This type of construction is frequently used for the pile-supported mats in Types 3, 4 and 5.

The significant difference between the plain raft and the compensated raft is in the volume of material that is excavated before the concrete raft is placed. In the plain raft design, the governing factor is the unit bearing value of the soil below the raft. This will determine its area.

It is to be noted that the plain raft made a better showing than the compensated raft. Probably the intensity of the design unit loading on the contact area between the soil and the base of the raft was higher with the compensated rafts, because of the confidence mistakenly placed in the theory of compensation. The wide and continued use of the compensated raft foundation in Mexico City, in spite of the many settlements which occurred with this type long before the quake, arises, no doubt, from the fact that it is the cheapest foundation available. The price paid for the initial saving looks high even if the possibility of future earthquakes is omitted from consideration.

Sectional wood piles, No. 3 in Fig. 2, are no longer in use. They have proved unsatisfactory because many of them did not go down vertically to bearing on the first stratum of cemented sand capable of giving them support at a depth of 110 ft. There are one or two cases in Mexico City where a modern building has recently been erected on an old foundation of this type. It seems unlikely that this type of foundation will get even second-hand use in the future.

Type 4 in Fig. 2 shows the old standby, a building resting on and locked to a concrete mat supported on attached long concrete piles driven to point bearing on the cemented sand stratum. All the buildings on this type of foundation that we examined came through the quake practically unscathed.

The same cannot be said for those built on mats hung from the tops of piles by yokes and adjustable screws. Such structures fared very badly. The purpose of this latter type of foundation is to provide a means of gradually lowering the building to street level as the area around it settles. There are other methods of lowering a building in conformity with area settlement which do not jeopardize the stability of its foundation.

Battered piles have not been used in Mexico to reduce earthquake damage. However, it seems good sense to resist the horizontal soil movement caused by a quake by introducing an opposite horizontal force at mat level. The resisting force should be applied as a direct axial load on the piles rather than as a bending load. The bending resistance of long piles in soft ground is only a small fraction of their axial load capacity. The need for added shock protection is obvious, and the increased cost of battered piles would be small. The use of battered piles should be considered in underpinning buildings.

Some few superstructure details were found to be sources of weakness, for example the cutting away of a considerable part of the core of a column to accommodate wires and switch boxes. However, the existence of occasional faulty details of design probably is a negligible factor in the total damage caused by the earthquake.

The extensive damage to curtain walls and to non-bearing cover concrete and plaster, throughout nearly all the seriously damaged buildings, might be criticized as due to faulty design. These non-bearing walls are neither better nor worse in design than those in most large cities in the United States where buildings are *not* designed to meet earthquake shock.

Mexico City designers were perhaps justified in assuming that a locality which had not suffered a single major earthquake in fifty years, and perhaps in several times that period—no records are available—did not present a major risk. With a few brilliant exceptions, this seems to have been the assumption on which the designers worked.

Several buildings that were under construction at the time of the quake were completely wrecked by it. These failures might have been avoided had partition walls been in place.

A favorite refuge of engineers when faced with damage and destruction of the sort that visited Mexico City is the theory of vibrations. According to this theory, if the frequency of vibration of a building comes into consonance with that of a shock, a build-up may result, which will wreck the best designed and most stoutly built structure.

This is a comfortable theory since the responsibility for any collapse can be passed along gracefully to the Almighty. Undoubtedly there have been instances of failures due to such vibrations in very simple and uniform structures, although proof by observation is hard to find after the damage has been done.

In our study of damaged buildings in Mexico City we find a considerable uniformity in the location of maximum damage. It occurs in most cases between the third and fifth floors. The structural types of these buildings, their heights, and their space layouts vary through a wide range. There seems to be no observable relationship between extent of damage and either building height or structural type. The one factor which is consistent in its results is that of type of foundation. The natural frequencies of all these buildings, like all their other characteristics, must vary widely. The dissimilarity of frequencies does not seem to override the type of foundation. Then why this uniformity in the location of the areas of major failures?

Soil waves due to earthquakes are the result of vibrations presumably active at great depths. The actual movement of large volumes of soil is probably a surface phenomenon. This may partly explain the failure of the raft foundations without piles and the tilting of some buildings. The assumption that waves set in motion by earthquake vibrations do not produce actual displacement of soil except at or near the surface seems to be borne out by the fact that only very minor damage to sewers and water mains has been reported.

Some conclusions offered

At the present stage of the study of results of the Mexican earthquake, the following opinions are offered as simple, practical suggestions for changes in design and construction that will add to the resistance of any structure to earthquake damage. If adopted, these changes would increase the safety factor without a prohibitive increase in cost of construction.

1. The foundation. The one most important element in the design of an earthquake resistant structure in Mexico City is its foundation. This statement is of prime importance. While the building code of the City of Mexico devotes considerable space to requirements for earthquake resistance, it scarcely mentions the word "foundation" in this connection. In this it differs not at all from many other codes and from many writers on the subject. Yet there is nothing unusual or original about the conclusion that the foundation is of prime importance—Pacific Coast engineers have been stressing this factor for years.

If a pile foundation is used, the

piles should be battered—at least in three directions. This might increase the number of piles required by 20 to 30 percent, depending on the degree of batter. Where battered piles are used, axial loading can be fully effective only when sufficient vertical load is available to close the force triangle. For this purpose only the dead load of the structure can be counted on. When the dead load is insufficient to develop the required horizontal thrust, tension piles can be driven to supply it.

A pile foundation should be rigidly connected to the superstructure so that its damping effect on the shock waves can be fully developed.

2. Curtain walls and frame. All secondary internal structural members, particularly curtain walls, should be designed to act as internal bracing for the main structural skeleton both in bending and in shear. Curtain walls should be of concrete diagonally braced, so that they can act as stiffeners to the main structural members.

In any location where severe seismic disturbances must be considered as the most threatening factor in the design, diagonal bracing members, from foundation to roof, provide the cheapest and most effective safety feature.

Curtain walls should be carried up as the structure rises. A partly completed structure may have to resist a major quake. Without the curtain-wall bracing it may fail, even though as a completed structure it would come through safely.

Wherever possible the connections between columns and beams should be knee-braced. Outside stairwells should form an integral part of the main building structure.

3. Code requirements. The rebuilding of damaged structures should be governed by rigid code requirements. The present Mexico City code is obsolete but special addenda have been sent out to govern both reconstruction of damaged buildings and construction of new ones. Where settlement or other indications of foundation failure are observed, underpinning is essential. The code should specify the requirements for satisfactory underpinning.

A new or revised code should require that structures in which the frame has been damaged are to be rebuilt, not merely to a theoretical value equaling their strength before the quake, but to some fixed percentage well in excess of their previous capacity.

A structure that has been visibly damaged has certainly suffered strains and minor cracking which it will not be possible to evaluate exactly. An added safety factor is the only way in which these hidden defects can be offset.

4. Party walls. In at least five instances, severe damage was suffered by adjacent buildings where each possessed a separate wall which adjoined the wall of its neighbor, instead of both sharing a mutual party wall. One wall in some instances acted as a battering ram buffeting the other. In future construction, the walls of adjacent buildings should be tied rigidly together, or a protective space of two or more feet should be left between adjoining high buildings.

Authorities take effective action

Mexican authorities have handled and continue to handle the responsibilities arising from this disaster in a masterful way. Building authorities in the United States, and in any country where similar emergencies could occur, might be interested in a brief outline of the procedures followed in Mexico City.

The principal shock occurred at 2:40 a.m. By 9:00 a.m. the police and certain available units of the Army had blocked off, and placed under guard, the principal danger spots and the points at which rescue digging was under way.

During a bombing little or no thought is given to the problems of rebuilding, but in the case of an earthquake which results in anything less than total destruction, a large proportion of the injured structures will be repaired, and the repair and rebuilding will start within a matter of hours.

It is certain that these first repairs will in some cases bury the evidence—structural cracks, and possibly faulty initial construction—on which must be based the decision of a building department as to the necessary extent and method of repair. In Mexico City the Building Department knew it would ultimately be required to approve the reconstruction work and it was taking no chances on a blindfold judgment.

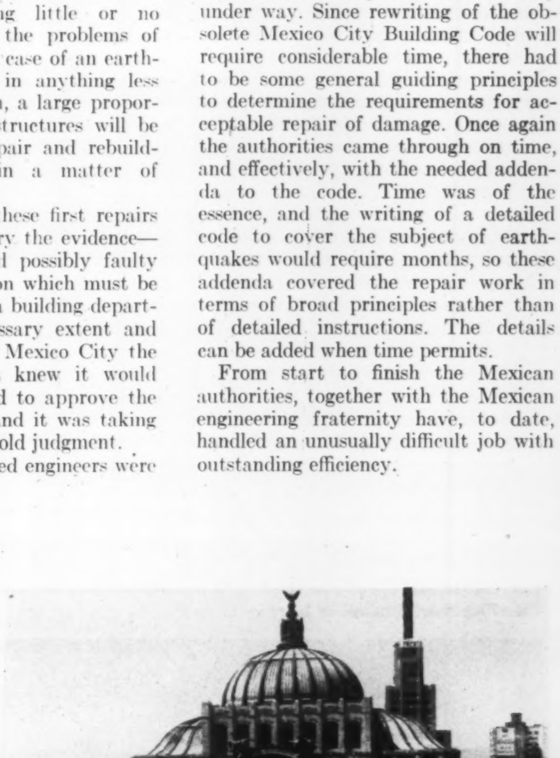
A number of qualified engineers were asked to report at once to the authorities. To each of these men was allocated a group of three to five buildings which showed at least superficial damage. The engineers were expected to report on the condition and the extent of damage—particularly basic structural damage—to each building allotted to them. This was a service to their city and no fees were to be paid. They were given no authority to decide on the extent or method of repair. They were merely to get the facts on the record. This work, we understand, was completed within less than three days.

Owners were then allowed to select their own engineers and designers but any work installed was at their own risk until the Department had granted them formal approval.

It was evident that a great deal of engineering study would be required before examination of plans could be completed by the regular examiners of the Department. Once again a recruiting call went out. Competent engineers were asked to take on, in part, the Building Department's duties—to study and approve repairs, and to supervise the actual work as it progressed.

Much of the repair work is already under way. Since rewriting of the obsolete Mexico City Building Code will require considerable time, there had to be some general guiding principles to determine the requirements for acceptable repair of damage. Once again the authorities came through on time, and effectively, with the needed addenda to the code. Time was of the essence, and the writing of a detailed code to cover the subject of earthquakes would require months, so these addenda covered the repair work in terms of broad principles rather than of detailed instructions. The details can be added when time permits.

From start to finish the Mexican authorities, together with the Mexican engineering fraternity have, to date, handled an unusually difficult job with outstanding efficiency.



Palace of Fine Arts, which previously had suffered from subsidence, was not further damaged by quake. It rests on a massive reinforced concrete slab.

SOCIETY NEWS

The Society's new President, Louis R. Howson, figures prominently in these two Convention shots. In upper view he receives the congratulations and good wishes of retiring President Mason Lockwood. In lower view he is shown at Monday's Professional Unity Luncheon with Joseph W. Barker, president of EJC and featured speaker.

Memorable Program Marks ASCE Annual Convention

This year's Annual Convention—held at the Statler Hotel in New York against a backdrop of commercial displays—was a success on all counts. The week-long program, October 14-18, offered 42 technical sessions; over 50 committee meetings; a battery of distinguished speakers, including New York's Robert Moses and Federal Highway Administrator Bertram D. Tallamy; the annual presentation of prizes and honors; induction of new officers; a vital all-day Conditions of Practice program; and tours to some of the top-priority projects in the metropolitan area. The Civil Engineering Show, the first such exhibit of equipment and services ever held at a Society Convention, drew crowds of engineers interested in seeing the latest devices and developments available to them. It seemed to be especially popular with the younger men.

Each year the Annual Convention committees of Metropolitan Section members in charge of arrangements seem to outdo themselves at the difficult task of providing perennially fresh and interesting social programs. There were daily luncheons and dinners, a kickoff cocktail party (for which engineering firms and companies in the area generously picked up the tab), the annual dinner-dance, a smoker, and alumni get-togethers. The ladies had their own program, which included visits to such landmarks as the Governor's Mansion at Princeton. Barclay G. Johnson was general chairman, and Thomas J. Fratar, vice-chairman. Mrs. Johnson headed the Women's Committee.

On hand for all these events was a total registered attendance of 2,195. The large foreign representation included Australian engineers, who had come from across the world to participate in the Power Division program on underground powerhouses. Italy, Sweden, Canada, and Mexico were among the other foreign countries represented.

Conditions of Practice Sessions

With a Russian satellite circling the earth in outer space, Monday's Conditions of Practice program seemed to take on special urgency, concerned as it was with how to obtain enough young civil engineers to meet the needs of government and industry, how to obtain better trained civil engineering graduates, and how to hang on to the civil engineers we already have. These allied problems were attacked in a morning session devoted to a Report of the Task Committee on Study of Economic Objectives, and in an afternoon session on education sponsored by the Task Committee on Professional Education.

Task Committee Chairman Lloyd D. Knapp moderated the Monday morning program and explained the committee's

Luncheon trio below consists of Elsie Eaves, business news analyst for McGraw-Hill and first woman member of ASCE, with ASCE Director Clarence L. Eckel (center) and new Vice-President Samuel B. Morris.

Viewed at the Technical Division Luncheon on Tuesday are President Mason Lockwood with speaker Robert Moses (center) and Vice-President Frank A. Marston, who presided at the luncheon.

assignment, which had been to find out what ASCE can do to improve the economic status of its members. The legal implications of any possible change in Society status involved in this question had been put to Ben R. Clark, legal counsel for ASCE. What the Society *can do,* on both a long-range and short-range basis, to improve the status of its members and the profession was discussed by committee members Charles Yoder and Lawrence A. Elsener.

The committee's long-range recommendations, as outlined by Mr. Yoder, include working toward unity of the profession; increased emphasis on registration; better public relations (not a selling job, but an educating job); better training of civil engineers through more attention to raising engineering school standards; and strong individual effort to maintain high professional standards. Said Mr. Yoder, "There is room for each of us to lend a hand and increase the prestige of the profession by providing a better product."

In the discussion period that concluded the morning program, Milton Alpern, president of the Metropolitan Section's Junior Forum, hailed the report as "wonderful evidence to the young engineer that ASCE is not cold and aloof." He noted that, "The ball has been thrown to the profession, and it behooves the young engineer to take it up." Other stimulating discussions—representing the viewpoints of the engineering teacher and the government employee—were presented by Prof. Thomas C. Shedd, of the University of Illinois, and Alfred R. Golze, director of programs and finance for the Bureau of Reclamation, Washington, D. C.

The important afternoon session on engineering education centered about the final report of the ASCE Task Committee on Professional Education (until recently the Task Committee on Engineering Education). The membership of this committee, consisting of three practicing engineers and three consultants, has remained practically constant since it was set up in 1953. The committee's four-year pilot study was based on a poll of membership opinion conducted for it by the Opinion Research Corporation, of Princeton, N. J.

After Chairman Adolph Ackerman had outlined some of the limitations of such surveys, the other committee members analyzed various phases of the report. Some of the disquieting facts in the civil engineering education situation were brought out by Prof. John Wilbur, head of the civil and sanitary engineering department at M.I.T. Despite the seeming rise in undergraduate civil engineering enrollment, the increase is so far behind that for the other branches of engineering that civil engineering enrollment "is actually losing ground," Professor Wilbur warned. Unhappily about 40 percent of the members polled feel unappreciated by the public and believe that civil engineering rates lower with the public than do the other branches. Only about half the engineering deans polled are optimistic about the future of civil engineering. "Lack of promotion" (public relations) is seen as one reason for the disturbing outlook. On the more optimistic side, Rear Admiral Kirby Smith reminded his hearers that, "despite the spectacular appeal of the other branches, civil engineering is more intimately concerned with the public welfare than any other branch." Members should pay more attention to student affairs, and should encourage industry to contribute funds for educational purposes, he said.

Findings on civil engineering curricula—by Harvey O. Banks, director of the California Department of Water Resources, and Prof. F. B. Farquharson, director of the Engineering Experiment Station at the University of Washington—revealed serious dissatisfaction with current curricula. To assure an adequately trained engineering graduate, most practicing engineers favor five-year curricula, while most educators do not favor extending the present four-year curriculum. However, in later discussion from the floor several prominent educators, who had contributed to the poll, remarked that it was expediency alone—realization of the need to graduate as many engineers as possible as fast as possible—that had influenced their answers.

Federal Highway Administrator Bertram D. Tallamy (right), speaker at the Awards Luncheon, is introduced by ASCE President Louis R. Howson.

Dr. N. M. Newmark, head of the civil engineering department at the University of Illinois, emphasized that ASCE at all levels can and should work for better engineering education. It should coordinate the efforts of Sections and schools, reaching down to secondary school level. The situation, he said, "requires acceptance of the member's role as a professional. He must make it clear that professional training is a continuing performance."

In the final paper of the afternoon Mr. Ackerman ably summarized the conclusions and recommendations of his task committee which will be published in a later issue.

Professional Unity Luncheon

Another of today's burning topics—professional unity—was the theme of

AGC-ASCE Joint Cooperative Committee met during Convention to discuss mutual problems. Committee co-chairmen are Charles Molineaux for ASCE and Howard Dixon, AGC.

FOUNDED
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Civil Engineering Show—an innovation in ASCE Convention history—attracted much attention. Here a group of intent young men examines display of foundation equipment.

ASCE Task Committee on Engineering Education, which presented its challenging final report at Conditions of Practice session, is shown here. In usual order are Harvey O. Banks, Prof. F. B. Farquharson, Rear Admiral Kirby Smith, Carey H. Brown (Board of Direction Contact Member), Chairman Adolph J. Ackerman, Prof. N. M. Newmark, and Prof. John B. Wilbur.

the Monday luncheon, which was also sponsored by the Committee on Conditions of Practice. In the principal talk Joseph W. Barker, M. ASCE, president of Engineers Joint Council, made a stirring plea for an American Society of Engineers, to which every qualified engineer could belong. Such an organization "would speak for the entire profession on such questions as education, legislation, engineering philosophy, etc.," Dr. Barker said. The various branches of engineering would be represented by departments in the proposed unity organization.

Prominent Luncheon Speakers

Dynamic Robert Moses, "guiding genius" of so many metropolitan area improvements, was featured speaker at the Technical Divisions Luncheon on Tuesday. In his capacity as chairman of the New York State Power Authority, Mr. Moses gave a spirited talk on the St. Lawrence and Niagara Power Projects, with amusing backstage glimpses into the trials and problems inherent in promoting and carrying out such a mighty work. Under Mr. Moses' chairmanship, construction time on the billion-dollar project—which has been called the project of the century—has been cut from seven to five years. The present schedule calls for delivery of first power on September 1, 1958, and of full power on both sides of the river in September 1959.

Another gifted speaker—Bertram D. Tallamy, M. ASCE, Federal Highway Administrator—addressed the Awards Luncheon on Wednesday on another of the great projects challenging the profession today, the $50 billion road program. Speaking off the cuff, Mr. Tallamy tried to give his large audience an idea of the enormity of the program and of the sums involved, explaining that costs will be met by the highway users and not by new taxes. "In so far as design is concerned," he told the group, "I hope you will use good sound engineering judgment, plus imagination, so you won't have 41,000 miles of boring road." He asked for a "truly professional attitude in carrying out the program—an attitude that holds integrity above everything." He also urged that ASCE take the leadership in setting up a schedule of fees for consultants engaged on the program.

The challenge of building bases in the Antarctic, presented by R. H. Meade, M. ASCE, Rear Admiral, CEC, U.S. Navy, provided still another good luncheon program. At the Technical Division Luncheon on Thursday, Admiral Meade gave an idea of some of the almost insuperable problems the Navy faced in constructing bases for use in the International Geophysical Year. Called "Operation Deep Freeze," the job was to provide structures that would withstand wind loads of 100 mph, snow loads of 125 psf, and temperature differentials of up to 190 deg F.

Prizes and Honors

Awards were the order of the day on Wednesday. The morning business session featured the presentation of prizes for papers in Transactions, and at the Awards Luncheon that day the spotlight was on the new Honorary Members. In congratulating the fifteen engineers present to receive their prizes, retiring President Mason Lockwood observed that "Most of the important civil engineering literature of the Western Hemisphere is produced in ASCE publications." Seven other prize winners who were unable to be present will receive their awards later at convenient Society or Section meetings.

At the close of the Wednesday morning program Louis R. Howson, Chicago consultant, took office as 89th President of the Society. Some of the immediate problems facing the Society were discussed by Mr. Howson in his thoughtful inaugural address that leads off this issue. Also installed were two Vice-Presidents—Waldo G. Bowman, of New York City, for Zone I, and Samuel B. Morris, of Los Angeles, for Zone IV. The new Directors inducted are Philip C. Rutledge, District 1; Weston S. Evans, District 2; Tilton E. Shelburne, District 6; Craig P. Hazelet, District 9; Don H. Mattern, District 10; and John E. Rinne, District 11.

Honored at the Wednesday luncheon were three outstanding members—Prof. Whitney Clark Huntington, of Urbana, Ill.; Howard Scott Morse, of Indianapolis, Ind.; and Lorenzo Perez-Castro, of Mexico City. A fourth new Honorary Member, Dr. Karl Imhoff, of Essen, Germany, had received his certificate from Executive Secretary Wisely in Essen a few weeks earlier. Retiring President Mason Lockwood made the presentations to the other three and read the citations.

Premiere of Highway Film

One of the answers to the many times expressed wish for compelling material that would encourage high school students to study engineering is the U.S. Steel Corporation's film, "Jonah and the Highway," which had it public premiere at one of the Highway Division sessions. Dedicated to the highway engineer as a public service by U. S. Steel, the dramatic wide-screen film will be widely shown in commercial theaters. Later it will be released in 16 mm for showing to school and other groups of young people. It runs 27 minutes.

Student Chapter Conference

Metropolitan area students were out in force for the Student Chapter Conference on Wednesday afternoon. Here, too, the emphasis was on what the young civil engineer must study to prepare himself to be the best possible civil engineer. In the featured talk Prof. Jewell M. Garrelts, a Director of the Society and executive officer of the Columbia University department of civil engineering, said the engineer needs a broad general education in the liberal arts. High at the top of the list of essential subjects Professor Garrelts lists English and the basic sciences. "The ideal would be an A.B. degree before beginning the study of engineering," he said.

Convention Technical Program Reviewed

Although many of the Convention papers will be printed in later issues of Civil Engineering and of the Division Journals, a few believed to be of immediate interest are abstracted here for the information of members who were unable to attend the Convention.

At almost all of the Technical Division sessions at the New York Convention the standing-room-only sign came out as engineers jammed every meeting room at the spacious Statler Hotel. Ten of the Technical Divisions presented 130 papers in a full week of highly interesting programs culminating in a Convention tour on Friday afternoon to New York's International Airport where more than $100 million in construction is under way.

Underground power plants were a major theme of the technical sessions with nine papers presented by power engineers from the United States, Sweden, Italy, Australia and other parts of the world. The international symposium on underground power plants was developed largely by R. A. Sutherland, M. ASCE, of Ebasco Services, Inc., who has worked for two years to perfect the program on plants throughout the world.

Most of the plants were put underground for economic reasons; a few primarily for protection from avalanches or slides; only a relatively small number are underground for protection against war damage. The most common general recommendation of all speakers was that very much better geologic data be obtained on sites for such powerhouses. Much better economies in design and construction can be obtained by adequate preliminary investigations, including shafts and tunnels, into the area of major excavation. Orienting the principal excavation normal to the slope of the rock reduces considerably the forces to be resisted.

A most interesting paper came from the T-1 power station of the Snowy Mountain scheme in Australia, presented by Thomas A. Lang, A.M. ASCE, associate commissioner. It concerns rock behavior and the ability of rock bolts to support broken rock in the excavation for the machinery hall. Roof bolts used there are 1 in. in dia held by a slot and steel wedge in lengths of 2 to 20 ft. Prior experiments had shown that roof bolts could hold even crushed stone in an ordinary bucket turned upside down if undisturbed but that, if started by a jet of water, all of the rock would ravel out. Investigations into the bolting of crushed rock material have demonstrated that it is economical to reconstitute highly fractured and closely jointed rock with bolts and relatively light steel mesh to prevent start of movement. The amount of steel required in this major powerhouse for conventional steel-rib support would have been eight times the weight of steel used in bolting and the cost would have been five times greater. A sub-audible rock-noise amplifier, consisting of a geophone and amplifier, was used on the Snowy Mountain Project to warn against dangerous stress increases in rock.

Seismic considerations entered into the design of the Sudagai Project, a recently completed underground plant in Japan, reported by Tatsuo Mizukoshi and S. Mimura, of the Tokyo Electric Power Co. The difference of seismic forces on the ground and underground was studied intensively there with some indication that the underground amplitude is less than that on the surface. In one case where the period of an earthquake was 0.23 sec the underground displacement was shown to be 36 percent of that on the surface.

Italy has 57 underground power stations of more than 10,000-kw capacity each and eight more are under construction, reported Dr. Carlos Semenza, M. ASCE, of Venice, in a paper prepared with Dante Finzi and Mario Mainardis. It is expected that by 1960 the installed capacity of the Italian underground power stations will reach about 4,500,000 kw. The first underground stations in Italy were built to avoid danger of avalanches. In the period preceding World War II defense dictated location, especially for plants near the frontier. Recently the choice between underground and outdoor solutions has been mainly an economic and technical evaluation of all factors.

Half the water power developed in Sweden is produced in underground power stations, according to Torre Nilsson, civil engineer director of the Swedish State Power Board. The first underground plant was built in 1910. Current construction is 75 percent underground. The principal reason for underground plants is an economic one, Mr. Nilsson said, but the safety of underground plants against bomb damage is welcomed. Atom power stations are constructed underground for safety as well as for war protection. Year-round construction can be carried on underground even in the coldest climates, thus speed-

A. J. Ackerman, left, with Carlo Semenza and R. A. Sutherland. Mr. Semenza received the Rickey Medal with fellow Italian, Claudio Marcello.

Torre Nilsson, left, civil engineer director of the Swedish State Power Board, told about fast underground excavation. With him is Walter H. Furuskog.

Machinery Hall is excavation feature of the Snowy Mountain Project in Australia. Rock bolts proved economical to support 60-ft wide roof.

ing installation. An exceptionally large underground station currently under construction is Stornorrfors, which will operate at a head of 244 ft with four 130,000-kw units to be installed initially. The final development will have a capacity of 500,000 kw, will use 28,000 cfs, and will be Sweden's largest power station. Operation is scheduled for 1958.

An unusual feature of the Stornorrfors plant is the tailrace, excavated as a huge hard rock tunnel that has a width of 53 ft and a height of 87 ft. Two smaller tunnels would have required an area 18 percent larger to operate at no greater loss of head. Excavation was started with a big top heading; then in two successive benches of about 25 ft the balance of the section was taken out. Mucking is done with 4-cu yd electric shovels loading 20-cu yd trucks. Advance in the top heading has been as much as 22 ft per round, with about 1,500 cu yd of solid rock or 2,300 cu yd of loose rock removed each 24 hours. Light weight one-man drills and small-diameter steel contributed to fast drilling operations.

Unlined tunnels are a feature of the Haas underground hydroelectric power project of the Pacific Gas and Electric Co. As reported by J. Berry Cooke, A.M. ASCE, supervising civil engineer, it has been the practice of PG&E to use unlined tunnels where rock conditions permit because of major savings involved and satisfactory experience recorded. No rock falls have occurred in tunnels constructed since 1947 where proper "dental" work has been done during construction. An unsupported tunnel lined with concrete costs 50 percent more than an unlined tunnel of equal head loss. The conclusion is based on: $n=0.015$ for concrete, and $n=0.030$ applied to the design area of the unlined section. Lined inverts are not used. It is estimated that the cost of the 13-ft unlined 6¼-mile tunnel will be $500,000 less than a lined tunnel.

The winding Agno River in the Philippine Islands provides an opportunity for considerable additional head by construction of a long, free-flowing tailrace tunnel to a point 5 river miles downstream from the plant, explained Andrew Eberhardt, A.M. ASCE, chief civil engineer of the Harza Engineering Co., Chicago. The tailrace tunnel passes under the river at two points before finally discharging into it 7,000 ft downstream. The outstanding feature of the power station is the horizontal shaft setting of the three generating units. Savings in excavation and concrete are about one-third that required for vertical shaft setting. Reduction in construction time resulted from less quantities and from assembling the generator and turbine at the same time. Cost saving comes from using a horizontal straight-axis conical-type draft tube rather than the elbow type, and a greater hydraulic efficiency is obtained. The three-turbine generator units are arranged radially with the draft tubes converging into a tailrace tunnel.

Surveying and Mapping

In minor respects the Task Committee on the Status of Surveying and Mapping has reversed its original stand in a second interim report prepared for the Convention. Much objection was taken to the stand that land surveying should be regarded as an activity separate and distinct from engineering, so the task committee has retracted its recommendation but is not yet in position to make a final recommendation. Most discussers agreed that surveys for design and construction should be considered as engineering and confirmed generally the other categories recommended in the first interim report (Civil Engineering, March 1957).

Geodetic control for installation of a radio system utilizing 60-ft parabolic reflector antennas to provide additional

Chicago was well represented at the Convention to support incoming President Howson, shown in front with Mrs. Howson and Frank Edwards.

Middlebrooks Award is presented to C. I. Mansur by retiring President Lockwood. Co-winner John A. Focht, Jr. is at left and ASCE Secretary Wisely at right.

HOTEL STATLER
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public overseas telephone service and a television network link between the United States and Cuba was described by Max O. Laird, of the Long Lines Department of the American Telephone and Telegraph Co., and Antonio Aguilar of Cuba. The United States station is located in the Everglades near Florida City and the Cuba station on a hill overlooking Guanabo. Aiming the two narrow-beam parabolic reflector antennas was effected by computing azimuth, back azimuth, and distance between geographic positions for the antennas, determined by triangulation expansions from the existing geodetic control networks. The new facility was placed in service early in September this year.

Sanitary Engineering

J. F. Laboon, M. ASCE, director and chief engineer of the Allegheny County (Pennsylvania) Sanitary Authority, was lead-off man in the sanitary field with a paper on how the Pittsburgh area's new collector system will operate under controlled submergence. Some 30 miles of 69 miles of interceptor is in tunnel. The entire system is new and is designed to take storm water up to 250 percent of the dry-weather flow. Excess storm flow is rejected to creeks or rivers. The system is planned to take care of the needs of 71 municipalities until the year 2000. Submerged operation permits pumping at a lower head, use of a smaller wet well and similar economies. The system is designed for weekly pump-down to accelerate flow in the tunnels so that sediment will wash out. Five pumps with a total capacity of 200 mgd serve this requirement at an annual cost one-third less than for a conventional design.

Air pollution from radioactivity and smog was discussed in several papers. Ralph C. Palange, A.M. ASCE, and Stephen Megreian, of the U.S Public Health Service, described programs under way for monitoring the radioactivity in the air and in milk. The Public Health Service program includes the collection of basic data on the quality of water, on a long-term basis from fifty sampling stations on interstate and Great Lakes waters.

The effects of air pollution on airport visibility have become such that "the continuation of conditions affecting the metropolitan airports of New York City is incompatible with the need for safe, rapid and continuous aircraft service to the area," said William T. Ingram, M. ASCE, adjunct professor, and Louis C. McCabe, consultant, Research Division, both of New York University. Contributors to the haze and smog are thousands of buses, airplanes warming up on the field, as well as the expected smoke from industrial stacks and even from well-operated incinerators. Newark Airport is perhaps the most severely affected in the New York area. Sometimes the combination of smoke from burning refuse and emissions from near-by industry cause hazardous low visibility there while near-by areas out of the flow of air from these sources remain clear.

The Engineers Joint Council's policy statement on air pollution and its control was outlined by C. A. Bishop, director-chemical process and chemical engineering development for the U. S. Steel Corp. The statement accepts engineering responsibility in solution of air pollution problems. Control of industrial and domestic pollution may be attempted by dilution, abolition, or by treatment, he said. Treatment can be improved by superior combustion chambers, scrubbing facilities, settling, filters, mechanical separators, electrostatic precipitators and counteractants. Current thinking on pollution control leans heavily on provision for the reduction and treatment of wastes prior to the beginning of operations at new plants, a field in which all engineers have a responsibility and a part.

Highways

The challenge of urban transportation was thrown to the Highway Division sessions by Donald C. Wagner, managing director, City of Philadelphia, speaking before a session on the interstate system in urbanized areas. About 70 percent of the peak-hour travel to and from the business district, he declared, should be by rail mass transit. The rest of the travel can be either by private autos or buses. Cities that do not follow such a plan will face stagnation of and a heavy decline in values in their central business districts. Yet, Mr. Wagner pointed out, proposals to place mass rapid transit on rails along expressways, as has been done in the Congress Street Expressway in Chicago, are uniformly rejected. Unless cities move rapidly to see that their share of the interstate system is secured funds will go to rural areas where it is far easier to design and build expressway mileage.

Frank C. Turner, M. ASCE deputy commissioner and chief engineer of the U. S. Bureau of Public Roads, supported assistance for city arterial planning with the comment that the interstate highway system can be a powerful tool for replacement of slum areas, obsolete buildings, and decadent areas. Mr. Turner stated that the highway problem is larger per mile of project in urban areas and is magnified by the fact that highest traffic volumes occur in the areas where it is most difficult to get maximum number of lanes and right-of-way width.

Rex M. Whitton, M. ASCE, chief engineer of the Missouri Highway Commission, told the meeting that the right-of-way problem has become especially complex in urbanized areas where highway improvement has developed into a veritable race between construction of the highway and industrial or residential development of the area through which it passes. Said Mr. Whitton, "By the time we can complete necessary preliminaries and designs and return to acquire rights of way, we find a factory or 200 homes on the needed land. It results in spiraling rights-of-way costs. Greater public understanding of the value of the urban highways is needed, which may result in public approval for pressure on those who would delay or rob the program by boosting right-of-way costs beyond reason."

The George Washington Bridge, completed in the 1920's at a cost of $54 million, is to have a $182 million lower deck and approaches added to greatly increase its traffic capacity. Irving P. Gould, engineer of design for the Port of New York Authority, told a joint session of the Construction, Highway, and Structural Divisions. A second deck, intended primarily for mass transit, was provided for in the original design at an additional cost of $15 million for the bridge alone. Stiffening trusses 29 ft deep, planned for in the original structure, will now be added with the lower chord carrying the new deck. The upper deck will continue to carry eight lanes of vehicle traffic and the lower one will provide for six lanes, with the center two convertible to rail traffic if conditions warrant. By careful design for weight economy the new live and dead

Special hydraulic crane lifts Swedish muckers to roof of tailrace tunnel to scale loose rock.

load amounts to 46,300 lb per lin ft compared to 47,000 lb planned for in the 1920's design. Mr. Gould stated that most of the current expenditure would be for construction of the approaches. A 12-lane expressway in an open cut will replace the approach tunnels on the Manhattan side of the bridge, but later replacement apartments may be built in the air space over the approaches.

Precast, prestressed panels 4 ft high and 32 ft long stacked on edge to make an economical retaining wall at the New Jersey entrance to the third tube of the Lincoln Tunnel, were described by Frederick C. Lowy, M. ASCE, consulting engineer of New York. The very crowded work space at the site made it imperative that as much construction be done away from the area as was practical. Buttresses, founded on rock at about 32-ft centers, were built by conventional means. Prestressed panels were lowered into recesses, which were padded with expansion joint filler.

Water Control and Storage

Controlling, storing, serving, distributing, and even replacing water were covered in papers presented in different sessions. New England must be protected from floods moving down its rivers and from hurricanes coming in off the coast, said Brig. Gen. Alden K. Sibley, division engineer for the Corps of Engineers. Flood control must be achieved by numerous reservoirs on the tributaries designed to meet torrential-type floods rather than floods of inundation and for year-round use. In contrast to the orthodox river control problem the protection of coastal areas from hurricane-induced tidal inundation constitutes a revolutionary development in flood control in the United States. Tidal floods from Hurricane Carol in August 1955 cost 60 lives and $300 million in the coastal areas of the Northeast. For protection of Providence and Narragansett Bay the New England division engineer has recommended: (1) Construction of a concrete barrier and pumping station across the Providence River at Fox Point for the protection of the business center of Providence; and (2) construction of rock-filled barriers across the Sakonnet River. The Fox Point barrier would be a concrete gravity dam 1,100 ft long and would have five pumps with a combined capacity of 8,000 cfs under a head of 22 ft. The east barrier would be a 3,200-ft-long stone structure with a maximum base width of 700 ft and a water depth of 165 ft. The 7,100-ft-long west barrier, about 600 ft south of the Jamestown Bridge, would be of similar construction. Navigation openings for the east and west barriers of the lower bay are a real problem if large openings are required for navigation. Floating caissons, roll-out caissons or float-up gates are being considered. The cheapest means certainly would be to leave the openings ungated, which would have reduced previous storm heights by at least 8 ft.

An asphaltic concrete deck on rockfill Montgomery Dam retains about 5,000 acre-ft of water at elevation 10,868 for use by Colorado Springs, Colo. At its maximum section the dam has a height of 113 ft; the length is 1,900 ft. Upstream slope of the dam is 1 vertical on 1.7; the downstream slope of dumped rock averages 1 on 1.5. The asphaltic concrete deck is expected to be self adjusting to settlement. At ordinary temperature the asphaltic concrete is far more flexible than Portland cement, and laboratory investigations indicate considerable flexibility even at freezing temperatures. A feature of the construction of the deck was a turntable placed on top of the dam on which aggregate trucks were turned and backed down the slope and dumped. Next a distributor for penetration materials and finally the paver and trucks carrying plant mix were handled in similar manner. A vibratory roller was adapted to use on the slope. Surfacing the face of the dam was done in the 2½-month working season of 1957. The paper was presented by F. W. Scheidenhelm, whose firm worked with Black & Veatch on the structure.

Waterfront Structures

The greatly increasing interest of civil engineers in waterfront structures and the activities of the Waterways and Harbors Division is shown by the 20 papers on subjects ranging from wave forces on offshore towers to the effect of weapons on on-shore establishments. Discussion of forces on moored ships brought the observation that it is easier to build 100,000-ton tankers than to dock and moor them. Perhaps that is because building is someone else's problem, but even deepening channels is most difficult. To deepen the Thames 6 ft, material equivalent to dredging 20 ft has been removed in six years but only a 2-ft depth increase achieved. The Dutch are planning for 120,000-ton ships, but have given up on bringing them into harbors and will moor them in the open sea. Data are urgently needed on waves and mooring stresses that will be encountered under such conditions.

An additional $150 million is needed in waterfront programs to supplement the $22 million now available for Navy waterfront facilities directly attributable to the new weapons systems, said Rear Admiral Martin W. Kehart, M. ASCE, director of the Atlantic Division of the Navy Bureau of Yards and Docks. The jet airplane, requiring the supercarriers and nuclear power for ships, demands larger and completely different facilities. In comparing docking and dry-docking facilities required for carriers of the *Forrestal* class, Admiral Kehart stated that our two most modern ocean liners, the *United States* and the *America*, could be put side by side on the *Saratoga*'s flight deck. Completely rebuilding of a dry-dock is underway at Boston, and plans are being made for new dry-docks at San Francisco and Puget Sound. Handling nuclear fuel, even for submarines, requires heavy and very specialized equipment as well as decontaminating structures.

Passamaquoddy tides on the Canadian border of Maine are under extensive study, reported Lincoln Reid, hydraulic engineer for the Corps of Engineers in New England. The first year of the planned three-year international study utilized the 650 IBM analog computer but this model has proved to be too small. Instead the staff is using a 704 IBM at the G.E. laboratory in Lynn, Mass. With this machine the optimum power for tidal heads ranging from 22 down to 7 ft can be determined in 4½ minutes for a month of tide changes. Estimated energy of production is 1½ to 2 billion kwhr per year, which agrees with estimates made many years ago by the late Dexter Cooper, M. ASCE. More energy would be available from Kaplan turbines, but fixed-blade turbines seem more practical for this application. Present indications are that thirty 12,500-kw units might be most practical. Some pumped storage is being considered to smooth out the power flow.

Computers

Technical sessions indicated special interest in computers. In the field of water-works distribution M. B. McPherson, A.M. ASCE, and J. V. Radziul, of the Philadelphia Water Department, heartily recommended the McIlroy Analyzer for medium and large systems (digital computers will be increasingly used by consultants until more McIlroy Analyzers are available). For composite I-beam design, J. Hassani, of Whitman, Requardt & Associates, reported that a program has been developed for Remington-Rand's Univac 120 by which the properties of any section can be computed in one second—9,000 combinations have been processed and tabulated. For three-dimensional frames Frederick L. Ryder, of the research staff of Republic Aviation, stated that it is particularly easy to explore the effects of modifying the dimensions of structural members by use of electrical analogs.

What the Board Did During the Convention

The Board of Direction met at the Statler Hotel in New York on October 14 and 15. President Mason Lockwood was in the chair, and all members were present. First, on recommendation of its Executive Committee, the Board gave its approval to the actions that follow.

Washington Representation

The Board approved a plan to engage the Washington law firm of Covington and Burling to assist the Executive Secretary and his staff in representing the Society in an appropriate manner in Washington, D. C. This step was taken as a result of widespread feeling among members that ASCE should contribute to national affairs in all matters related to civil engineering.

Unity in the Profession

President Lockwood's statement, "Individual Engineers Want Unity", printed on page 33 of the August issue, was endorsed in principle by the Board.

World Construction Year

At the Buffalo meeting of the Board, approval had been given to ASCE participation in the World Construction Year (1960) jointly with Northwestern Technological Institute and the American Institute of Architects. At this meeting Lester Rogers, M. ASCE, of Chicago, was named to represent ASCE on the joint committee on arrangements.

United Engineering Center

The Board appointed Past-President E. R. Needles to represent ASCE on an inter-society committee formed for the purpose of developing a program for raising funds from among the membership for building the United Engineering Center in New York.

Foreign Membership

The Board accepted action by the Executive Committee to assume responsibility for studying the problems of foreign members in ASCE, and to advise on rules relating to membership requirements and procedures, Local Sections and Student Chapters abroad.

Change in Name of Bureau of Yards and Docks

Approval and endorsement was given by the Board to proposed legislation that would change the name of the Navy Bureau of Yards and Docks to "Bureau of Civil Engineering."

Second, the following actions were taken on matters brought to the attention of the Board by its standing and task committees.

EUSEC Education Conference

For the record, Executive Secretary W. H. Wisely reported on his attendance, as instructed by the Board, at the Third Conference on Engineering Education, held in Paris, September 16-20, under the auspices of the Engineering Societies of Western Europe and the United States (EUSEC).

EUSEC Meets in New York in 1958

During the EUSEC Conference two meetings of the secretaries of the EUSEC societies devoted their efforts primarily to planning the 1958 meeting of EUSEC, to be held in New York City.

Honorary Membership to Dr. Imhoff

In electing Dr. Karl Imhoff, of Essen, Germany, to honorary membership in

New Board of Direction meets during Annual Convention in New York. Seated are Executive Secretary William H. Wisely; Vice-President Norman R. Moore; Vice-President Francis S. Friel; Past-President Mason Lockwood; President Louis R. Howson; Past-President E. R. Needles; Vice-President Samuel B. Morris; and Vice-President Waldo G. Bowman. In the second row are Director Randle B. Alexander; Director Clinton D. Hanover; Director E. Leland Durkee; Director John P. Riley; Director Howard F. Peckworth; Director John E. Rinne; Director Philip C. Rutledge; Director Louis E. Rydell; and Director Finley B. Laverty. In the third row are Director Craig P. Hazelet; Director Weston S. Evans; Director Clarence L. Eckel; Director R. Robinson Rowe (N. G. Neare); Director William J. Hedley; Director Don H. Mattern; Director Tilton E. Shelburne; Director Mason C. Prichard; Director Robert H. Sherlock; and Director Carey H. Brown.

June 1957, the Board waived the requirement that he be present to receive his certificate in person at the Annual Convention in October. Instead the Board authorized Executive Secretary Wisely to arrange to make the formal presentation to Dr. Imhoff in his home city of Essen. This was done on September 23 in the presence of Dr. Imhoff's intimate friends and family at the Hotel Essener, the actual presentation being made in part in German. Dr. Imhoff was honored for his world-wide contribution to the health and welfare of humanity, and it was also felt that the presentation contributed greatly to better understanding and amity among free countries.

Committee on Publications

For the Publications Committee, Chairman Jewell M. Garrelts, reporting on this important Society activity, said that "30,000 members are now enrolled in at least one Technical Division . . . 17,500 of these are enrolled in two Divisions . . . and each month 1,000 members order reprints of Proceeding Papers in Journals other than those in which they are enrolled." He noted the increasing activity in publishing papers by both the Highway and Construction Divisions; and again complimented the fast-growing Pipe Line Division—only a year old, and having but one-half percent of the total registrants—for having produced during the year almost 3 percent of all the technical papers published in Journals. The volume of technical papers being processed this year by the staff totals 772, which is up 150 over the total of a year ago. An early issue of the Journal of Soil Mechanics and Foundations Division will include a report on chemical grouting. Progress reports of other groups are in preparation.

Division Activities

On recommendation of the Committee on Division Activities, of which Vice-President Frank A. Marston is chairman, the Board approved the following actions:

Technical Procedure Conference. An invitation of the Memphis Branch of the Mid-South Section was accepted to hold the 1958 Technical Procedure Conference in Memphis, Tenn., on May 1 and 2.

Nuclear Science and Engineering Congress. For the record it was reported that four Technical Divisions of ASCE are participating in the 1958 Nuclear Science and Engineering Congress, to be held in Chicago, March 16-21. James G. Terrill, Jr., of Washington, D. C., is ASCE's representative on the Program Committee for the Congress.

Award of Research Prizes. On recommendation of the Research Committee, of which Lowell E. Gregg is chairman, the Board approved the award of the Society's Research Prizes to M. J. Hvorslev, M. ASCE, Waterways Experiment Station; Bruce G. Johnston, M. ASCE, University of Michigan; and Lorenz G. Straub, M. ASCE, St. Anthony Falls Hydraulic Laboratory.

Technical Division Conferences. In the belief that Divisions should continue to receive encouragement for holding separate conferences for presentation of new information of significance to the membership and the profession, the Board approved the following conferences for 1958: Nuclear Science and Engineering Congress, Chicago, March 16-21, 1958; Engineering Mechanics, Brown University, June 11-14, 1958; Hydraulics, Atlanta, Ga., Aug. 20-22, 1958.

Conditions of Practice

On recommendation of the Committee on Conditions of Practice, of which Vice-President Glenn W. Holcomb is chairman, the Board took the following actions:

Questionnaire on Employment Conditions (Unionization). The Board authorized a questionnaire to be mailed to members in 1958, relating to unionization and other conditions surrounding the employment of engineers.

Engineering Education. An appropriation of $2,500 was approved for the preparation and printing of a brochure, directed to college freshmen, concerning the various satisfying aspects of a career in the profession of civil engineering. A number of educators have felt that the more glamorous branches of engineering are attracting a disproportionate share of engineering students. The Committee on Engineering Education, of which Dean R. P. Davis is chairman, believed that such a brochure would be effective for this purpose.

You Can Be a Civil Engineer is an attractive two-color 16-page booklet written to encourage qualified students in secondary schools to follow a career in civil engineering. Already 50,000 copies have been placed in the hands of engineering college deans, and Local Section officers and Branches for distribution to interested high school students. The Board approved a recommendation that a copy of the booklet be mailed to every member of the Society enlisting his active participation in a program to recruit young people into the profession.

Year-around schooling in engineering colleges was urged in a resolution passed by the Board. Present educational facilities and faculties are in service about nine months a year, declared to be an inefficient use of scarce and much-needed tools of education. The resolution came as the result of a long study by the Committee on Education. Not only would such year-round use of educational plants and teachers in engineering schools increase the output of trained civil engineers, but an extension of the proposal to public schools would relieve other overtaxed units of our whole educational system.

Local Section Conferences for 1958 were approved as follows:

1. Southeast: fourteen Local Sections and their Branches will meet at the time and place of the District 10 Council in the Spring of 1958. They are Alabama, Brazil, Republic of Colombia, Florida, Georgia, Louisiana, Miami, Nashville, North Carolina, Panama, Puerto Rico, South Carolina, Tennessee Valley, and Venezuela.

2. Middle Atlantic: sixteen Local Sections and their Branches will meet at the time and place of the District 9 Council in the Spring of 1958. They are Akron, Central Ohio, Cincinnati, Cleveland, Dayton, Delaware, Indiana, Kentucky, Lehigh Valley, Maryland, National Capital, Philadelphia, Pittsburgh, Toledo, Virginia, and West Virginia.

3. Pacific Northwest: eight Local Sections and their Branches will meet at a time and place not yet decided upon, but probably in Montana during the summer of 1958. They are Alaska, Columbia, Montana, Oregon, Seattle, Southern Idaho, Spokane and Tacoma.

A Faculty Advisers Conference, to be held during the Chicago Convention in February 1958, was approved.

A Society Policy Concerning Registration of Engineers was presented to the Board by the Committee on Conditions of Practice, debated at length, and approved in the form shown on another page of this issue. The Policy recommends inclusion in registration laws of provision for corporations to practice engineering if a majority of the officers, directors, and engineers in responsible charge of projects are registered in the state where the work is being done. It encourages, also, cooperation with other engineering organizations at local level to advance registration.

The Committee on Engineers in Public Practice has become a permanent standing committee, which the Board provided for by amending the By-laws by adding to Article VII, Section 4, a new paragraph (*j*). The requisite 30-day notice having been mailed to the Board and a written notice of the proposed amendment having been presented at the last meeting of the Board, the Board took action to adopt the new paragraph.

The Task Committee on Economic Advancement was appointed by the Board in October 1955 with former Director Lloyd D. Knapp, of Milwaukee, as chairman. Its interim report was submitted to the Board on January 5, 1957. At the current Board meeting the committee's final report was presented, its recommendations were approved, and the committee was relieved from further duty. The report is abstracted on another page of this issue, and the complete report will be printed in an early Board of Direction Journal for wide distribution to members.

The next meeting (annual) of the Committee on Conditions of Practice is scheduled to be held in Milwaukee in connection with the District 7 Council meeting, August 9-10, 1958.

Society Honors

In 1955 the Board created a Task Committee on Awards Policy "to study the existing structure of Society awards as well as requirements and conditions applicable to new awards that may be considered in the future." The committee, of which Director Howard F. Peckworth currently is chairman, reported to the Board its conviction that the Society should give every possible encouragement to the use of awards for the advancement of the civil engineering profession by emphasizing exceptionally meritorious examples. However, the committee is very emphatic that gifts to the Society for the support of awards must be without conditions involving the slightest appearance of endorsing any commercial concern or product. It recommended a revision of the Bylaws which would establish a standing committee of the Board on Awards Policy to consist of the President, Vice-Presidents, and Past-Presidents, to advise the Board on nominations for honorary membership and on all questions of policy for the establishment of new awards and the administration of old ones. The Board accepted for first reading a revised wording to Article VII, Section 2 (*b*) to make the above recommendations effective.

Professional Education

Appointed by the Board in October 1953 to review curricula, the Task Committee on Professional Education, of which Adolph J. Ackerman is chairman, rendered its final report. The report was based in part on a survey among members conducted by Opinion Research Corporation. The Board authorized publication of the Committee's report and conclusions in a single issue of CIVIL ENGINEERING.

ASCE-AGC Cooperative Committee

On request of the ASCE-AGC Cooperative Committee, the Board endorsed the following statement which already has been endorsed by the AGC and AIA:

"Where contractors are required to provide surety bond, they should be left free to secure them from such companies as they see fit, and that it is undesirable practice to require such bonds to be purchased locally or through some specified agent or company. It is proper for the owner to reserve the right to approve the surety company and the form of the bond, but such approval should be based on the propriety of the form and on the financial soundness of the company and its known administrative policies in handling cases of default and should not be arbitrary for the purpose of forcing the use of any particular company or agent."

Classification of Members

The report of the Committee on Classification of Members, of which Frank L. Weaver is chairman, has been sent to all Local Sections for comment. To date 39 Local Sections and Branches have responded. The final report of the committee will be submitted to the Board for consideration at its meetings in Chicago on February 24 and 25, 1958.

United Engineering Center

Director John P. Riley reported to the Board on progress toward construction of a United Engineering Center in New York.

Mead Prize Winners

On recommendation of the Committee on Professional Practice, of which Director George S. Richardson is chairman, announcement of the Daniel W. Mead Prize winners was made as follows: Student Prize to Robert Frowein, of the University of California, and the Junior Member Prize to Robert Braden, of Houston, Tex. The subject for both competitions this year was "Under What Conditions Should Faculty Members Engage in Outside Professional Engineering Practice?"

Engineering Foundation

Elmer K. Timby, senior ASCE representative on Engineering Foundation, reported that during the past year 28 research projects were under way for which Foundation grants of $56,000 were approved. This "seed money" drew additional support from industry estimated at a half million dollars. Of the 28 projects for the year only six were under the sponsorship of ASCE. However, work is being done on columns, on welding, on riveted and bolted joints, reinforced concrete, structural steel, painting, wave action, non alloys, heat flow, corrosion, fluid meters, wood poles, and permafrost. During the year the Blanche H. McHenry Memorial Fund of about $400,000 became available to the Foundation.

Committee on Standards

The chairman of the Committee on Standards, Clarence A. Willson, reported that his committee is administering nearly 100 Standards projects through the American Standards Association. As one result of an extensive survey of the current status of these projects, some of them will be expanded, certain projects no longer needed will be discontinued, and new projects will be created. The work of the Committee on Standards is carried on with the active cooperation of the several Technical Divisions of ASCE, particularly in furnishing personnel for projects.

Committee on Voluntary Fund

Director Don M. Corbett, chairman of the Committee on Voluntary Fund, reported the feeling of his committee that the fund should be allowed to accumulate to $100,000, after which both interest and annual accretions should be spent for some useful purpose, yet to be spelled out in detail.

Application Classification Committee

The Application Classification Committee, of which Albert Haertlein is chairman, is advisory to the Committee on Membership Qualification of the Board. Included in its report of its operations for the year is to be noted the statement that the number of applications for membership during the past fiscal year far exceeds that for any previous year in the past five years. About half of these were from recent graduates.

FISCAL YEAR	TOTAL APPLICATIONS
1953	3,644
1954	3,807
1955	3,642
1956	4,086
1957	5,102

Revision of Manual 29

At the request of the Board of Direction, a revision of Manual 29 was undertaken by a committee of which Louis R. Howson has been chairman. The revision has been submitted to the Committee on Professional Practice for approval. It contains a modification and upward revision of the fee curve and extends it to cover projects up to $100 million. [The subcommittee was instructed by the new Board to make a special study to develop fee curves covering highway engineering consulting services, utilizing the assistance of outside services and agencies as needed.]

Engineers Joint Council

Past-President E. R. Needles, contact member for the Board on EJC, reported that EJC's Manual for Consulting Engineers is ready for distribution. It is arranged so that each constituent society can supply its own details concerning operations in its own special field.

He also reported favorable action on the application of the Western Society of Engineers for affiliate membership in EJC.

Engineering Manpower Commission

As ASCE's representative on the Engineering Manpower Commission, Past-President Gail A. Hathaway reported that the commission is continuing to give help to engineers on their military service problems, both on an individual basis and on the development of top-level policy. As a result of earlier EMC efforts, the elements of the engineering manpower problem have been changing basically. No longer is the problem one of a dearth of students; it has changed to one of the ability of institutions of higher education to accept increasing numbers of students without sacrificing the quality of their education. In November a national meeting is to be held in Chicago to define the new problem and to rally additional support to our engineering schools. The meeting is to be sponsored jointly by the Engineering Manpower Commission of Engineers Joint Council, the Scientific Manpower Commission, the National Science Foundation, and the National Research Council.

Budget for 1958

Vice-President Francis S. Friel, chairman of the Budget Committee, reported the detailed recommendations of his committee for a balanced budget for 1958 totaling $1,532,643. Included in the budget are provisions for a mid-western advertising representative for CIVIL ENGINEERING, and a full-time public relations department at Society Headquarters. Believing the recommended budget to be well balanced and in keeping with the evident desire of the membership for a broader scope of activity in all phases of Society operation, the Board approved the budget.

The Budget Committee also reported that one result of the past year's operation was a surplus of about $75,000, coming almost entirely from greater-than-anticipated income from entrance fees, dues, advertising, and sale of publications.

John Fritz Medal Award

The John Fritz Medal Board of Award announced the 1958 Award to John Robert Suman, of the AIME, with the following citation: "Pioneer in the application of engineering principles to the development, production, and conservation of petroleum and natural gas; and one who takes a keen interest and real pleasure in inspiring men to make the most of their talents."

Visits and Travel

For the record it was reported that, since June, members of the Board had made 65 visits to organizations of the Society other than their own Board meetings. It is to be noted that 24 visits were by President Lockwood, and that during his term of office he had traveled 90,000 miles on official Society business. Since June members of Headquarters staff had made 25 visits.

Convention Appreciation

The Board expressed its formal gratitude to its Meetings Committee for the excellent Annual Convention—unquestionably one of the best conventions.

New Board Meets

The Board as constituted for 1958 met briefly on October 17 at the Statler Hotel for an organization meeting, with President Louis R. Howson in the chair and with all members present. The principal business was to confirm President Howson's appointments to the Board and Society committees. The names—a long list—will appear in the December issue.

ASCE Adopts Registration Policy

After intensive study by the Board's Committee on Conditions of Practice and the subcommittees on Professional Practice and on Registration, the Board adopted the professional engineers registration policy, at its meeting during the Convention, quoted in full as follows:

"The American Society of Civil Engineers endorses and supports the registration of professional engineers and land surveyors as being in the best interest of the general public. In support of this policy, the American Society of Civil Engineers:

1. Approves the Model Law as representative of minimum requirements for registration, and will cooperate with other groups in developing revisions that may be desirable from time to time.

2. Continues its financial support of the activities of the National Council of State Boards of Engineering Examiners, and will cooperate with that Council in the furtherance of engineering registration policies and procedures.

3. As a constituent society of Engineers Joint Council, recommends the full use of the resources of EJC in coordinating the broad interests of all branches of the engineering profession for effective cooperation with the NCSBEE.

4. Supports the premise that registration be categoried in the major branches, with emphasis on "professional engineering" rather than on a specific specialty of engineering.

5. Endorses the aim that certification by the National Bureau of Engineering Registration be recognized on a nationwide and territorial basis and used as a means of implementing registration through reciprocity by all state and territorial boards.

6. Recommends the development of written and oral examinations for Professional Engineers, Engineers-in-Training, and Land Surveyors of a character that will result in the furtherance of reciprocity on a nationwide and territorial basis.

7. Recognizes that a large number of corporations presently offer and render engineering services to the general public on a fee basis, and recommends that the protection of the general public be assured by requiring that such corporations satisfy the following list of requirements:

(*a*) The majority of the officers shall be registered professional engineers in the state of incorporation.

(*b*) The majority of the directors shall be registered professional engineers in the state of incorporation.

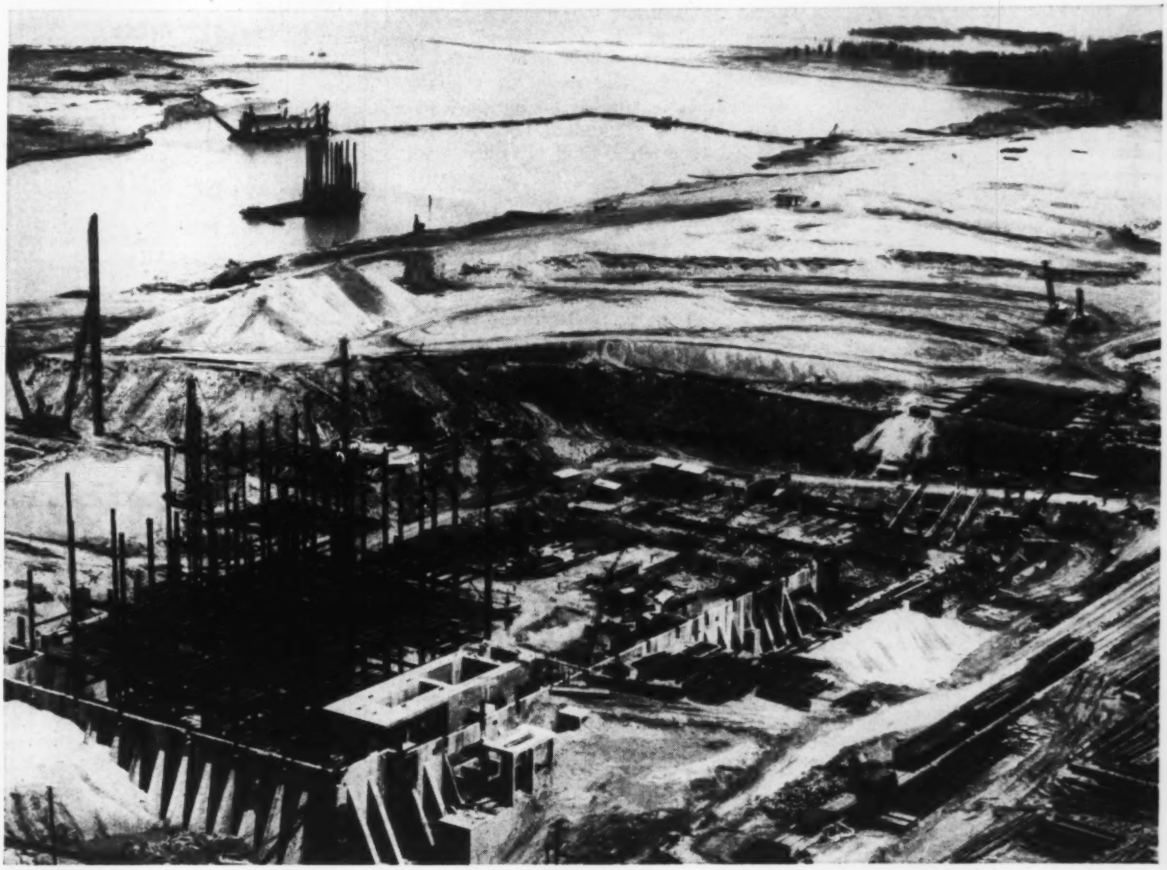
(*c*) The engineers in responsible charge of the practice of engineering shall be licensed in the state having jurisdiction over the performance of such practice.

8. Encourages its Local Section and District Councils to cooperate with other local engineering organizations in the advancement of engineering registration as an important step in professional development."

HOW TO HANDLE WET JOBS

#39 of a Series

Project: Thos. H. Allen Electric Generating Station, Memphis, Tennessee
Engineers: Burns & Roe, Inc.
Contractor: J. A. Jones Construction Company
Pumping Contractor: WELLPOINT DEWATERING CORP., NEW YORK



Big excavation at Mississippi's edge faces tricky water problem. Here's how . . .

Dewatering Plan Safeguards Site as River Rises

With the Mississippi River due to rise, contractor J. A. Jones was confronted with this ground-water problem. The soil was medium to coarse sand with a stratified overburden. Seepage through the overburden — pressed on by the swollen river—would imperil the excavation slopes.

- **To head off trouble,** Griffin engineers devised a "double-play" strategy. Vertical sand drains were installed to intercept the seepage—then relay the water downward where it was handled by a wellpoint system.
- **Result: An economical** (1-stage) Griffin wellpoint system kept firm control of 28 ft of water—inside a perimeter of half-mile length. With dry conditions, the job proceeded safely, on schedule. When *you* have wet work, work with Griffin.

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Task of Economic Advancement Committee Completed

After two years of thoughtful consideration the "Knapp Committee," which was directed by the Board to look into what the Society might do to improve the economic status of its members, completed its final report. The recommendations in the report were approved and the committee was discharged with thanks.

While the Constitution defines the Society's objectives to be "the advancement of the science and profession of engineering," the committee concluded early in its deliberations that men whose minds are oppressed by economic burdens do not attain the higher levels of professional achievement. "It is a matter of simple justice that engineers' compensation should be in reasonable proportion to the value of the services . . . ," the committee's report stated. Direct efforts to improve engineers' compensation are less likely to be effective than the creation of a surrounding climate favorable to economic growth, the Committee said.

Tax Status Examined

At the request of the Committee, the Society's legal counsel considered the possible advantages to the Society that might come from being included in the Internal Revenue Bureau's Classification 501 (*c*) 6 instead of maintaining its present classification 501 (*c*) 3. With respect to salaries and fees, counsel concluded that the Society, its District Councils, and its Local Sections can *recommend* minimum salary scales or fee schedules without jeopardizing its tax status, but may not take steps to *enforce* them.

Regarding legislative activity, counsel concluded that even under its present classification, 501 (*c*) 3, the Society *can* engage in attempts to influence legislation "if the legislation were incident to, or closely connected with the purposes of the Society, and if the sum total of the activities is *not substantial.*" It is the considered opinion of the Knapp Committee that for the present the Society should govern its activities so as to maintain its present tax status as a purely scientific and educational organization; and that several immediate and long-range objectives can be engaged in without jeopardizing the Society's present classification.

The immediate steps recommended to be taken are: (1) to set up a strong representation for the Society in Washington, D. C.; (2) advise Local Sections that the Society's staff is available for assistance in carrying out its legislative activities; (3) increase headquarters staff to provide the assistance desired; (4) add staff assistance to reestablish the practice of providing, on request, aid in developing and establishing equitable classification and salary schedules for groups of employers of engineers and their employees; and (5) reexamine the Society's fee curves to bring them up to date with current practice.

In the long-range category the Committee was strongly persuaded that the Society must: (1) continue efforts to secure effective unity of the engineering profession; (2) work to extend registration in both public and private practice; (3) increase the public relations department of Headquarters to add emphasis to the public relations program at both local and national levels; (4) work to secure better salaries for engineering teachers; (5) promote the establishment and recognition of engineering schools as professional schools; (6) give proper publicity to disciplinary actions taken by the Board for violation of the Code of Ethics by its members; (7) study and recommend steps which will improve the professional employment conditions in large engineering offices; (8) continue to give advice and guidance in matters concerning labor relations to the extent permitted by the Taft-Hartley Act; and (9) develop definitions of the functions of technicians and subprofessional, preprofessional, and professional engineers.

In the opinion of legal counsel, none of the activities listed above would affect the present tax status of the Society, nor that of UET or EJC with which ASCE is associated.

ASCE QUARTERLY ENGINEERING SALARY INDEX

Consulting Firms

City	Current	Last Quarter
Atlanta	1.11	1.10
Baltimore	1.10	1.09
Boston	1.13	1.09
Chicago	1.12	1.12
Denver	1.14	1.11
Houston	1.08	1.04
Kansas City	1.11	1.08
Los Angeles	1.16	1.14
New Orleans	(insufficient	returns)
New York	1.17	1.15
Pittsburgh	0.91	1.05
Portland	1.15	1.08
San Francisco	1.21	1.15
Seattle	1.07	1.05

Highway Departments

Region	Current	Last Quarter
1, New England	0.88	0.84
II, Mid. Atlantic	1.12	1.10
III, Mid. West	1.19	1.16
IV, South	1.05	1.04
V, West	0.96	0.96
VI, Far West	1.12	1.06

SOCIETY AWARDS AND FELLOWSHIPS AVAILABLE

DANIEL W. MEAD PRIZES:	*1958 contest closes May 1, 1958. See 1956 Official Register, page 132; July 1957 issue of CIVIL ENGINEERING, page 72.*
FREEMAN FELLOWSHIP:	*1958-1959 award closes May 1, 1958. See Official Register, page 142.*
J. WALDO SMITH HYDRAULIC FELLOWSHIP:	*1958-1959 award closes May 1, 1958. See Official Register, page 143.*

Civil Engineer Wins Freeman Fellowship

Herbert L. Ackermann, J.M. ASCE, an instructor in civil engineering at Carnegie Institute of Technology, has been awarded the Freeman Fellowship for the 1957-1958 academic year. Mr. Ackermann graduated from Carnegie Institute in 1955 with the bachelor of science degree. He continued to study there on a part-time basis, while serving as an instructor in the civil engineering department, and received his master's degree last June. As Freeman Fellow he will continue a study of "The Hydraulic Transportation of Sand in a Pipe," begun for his master's thesis.

H. L. Ackermann

The Freeman Fellowship was established in 1924 by the late John R. Freemen, Past-President and Honorary Member of ASCE, to encourage and aid young engineers doing research in the field of hydraulics. By informal arrangement with ASME, the two societies alternate in presenting the grants. The stipend is about $2,000. Applicants must be young members of either ASCE or ASME.

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NOTES FROM THE LOCAL SECTIONS

(Copy for these columns must be received by the fifth of the month preceding date of publication)

Members and guests of the **Arizona Section** assembled early one morning for a day of business and pleasure. First on the agenda was a field trip which took the group to Sunset Crater and then to the Pueblo ruins of the Wupatki National Monument where a guide explained the excavations. After a picnic lunch, there was a business meeting at which the proposed redistricting of District 11 was discussed by R. Robinson Rowe, Leigh Gardner, and others.

An exciting and pertinent program highlighted a recent meeting of the **Georgia Section** in conjunction with the Society of American Military Engineers. Dr. Konrad K. Dannenberg, of the Redstone Arsenal at Huntsville, Ala., presented an illustrated lecture on guided missiles from the V-2 to the ICBM. Dr. Dannenberg also explained his part in the missile program—he is responsible for the direction of missile liaison to contractors engaged in research development and production contracts. The **Central Savannah River Valley Branch** featured an illustrated talk by Thomas B. Hogan, of Armco Drainage & Metal Products, on "Flexibility Underground" at its September meeting. The **Savannah Branch** heard an interesting discussion on the relation of engineering to city government. Featured speaker was F. A. Jacocks, Savannah city manager.

A lively meeting of the **Intermountain Section** was highlighted by an address by Axel D. Peterson, president of Timber Engineering Company of San Francisco, who spoke on "Timber Engineering Design". Mr. Peterson's discussion was made more vivid by a movie.

Featured event at a recent meeting of the **Maine Section's Vermont Branch** was a technical program presented by Vermont Highway Department officials. The program, "Engineering for Vermont's Thruway Program", was chaired by Reinhold Thieme. First speaker was William Poeter, Commissioner of the Vermont Highway Department, who gave a talk on the state's thruway program and discussed some of the department's problems. Other engineers of the Highway Department dealt with specialized phases of their work. Speakers were Herbert Farrington, Gordon Lane, Joseph Bishop, and Pat Radigan.

Congratulations to the **Metropolitan Section** on its brand new newsletter, brimming with news at both the local and national level. Frederick S. Merritt is chairman of the Section's Publications Committee.

A social hour and dinner initiated the program at the **Mid-Missouri Section's** annual meeting. Speaker of the evening was Professor Kary Evans, who reported on the Oklahoma City Council meeting. New officers, unanimously elected, are Leon Hershkowitz, president; Lewis D. Asmus, first vice-president; William Sangster, second vice-president; and Chester Baker, secretary-treasurer.

Two speakers, well equipped with slides, illustrations and much interesting information, presented a program on prestressed concrete at the September meeting of the **National Capital Section.** E. L. Erickson, chief of the Bridge Division of the Bureau of Public Roads, spoke on the "Selection of Factors in Criteria for Prestressed Concrete Bridges by the Bureau of Public Roads," and gave a brief account of the role played by the Bureau in the introduction of prestressed concrete design to the United States. D. P. Jenny, structural engineer for the Portland Cement Association, discussed the use of prestressed concrete in building construction.

ASCE CONVENTIONS

CHICAGO CONVENTION

Chicago, Ill.
Sherman Hotel
February 24-28, 1958

PORTLAND CONVENTION

Portland, Ore.
Multnomah Hotel
June 23-27, 1958

ANNUAL CONVENTION

New York, N. Y.
Hotel Statler
October 13-17, 1958

DISTRICT COUNCIL MEETINGS

DISTRICT 3 COUNCIL CONFERENCE

Syracuse, N. Y.
Drumlin's Country Club
November 23

LOCAL SECTION MEETINGS

Arizona—Annual fall meeting at the Westward Ho Hotel, Phoenix, Ariz., November 16.

Illinois—Luncheon meetings at the Chicago Engineers Club every Friday. Annual dinner meeting at the Sherman Hotel, Chicago, Ill., December 12.

Metropolitan—Meeting in the Engineering Societies Building, November 20, at 7 p.m. Program on Consolidated Edison's Indian Point Nuclear Power Plant.

Miami—Dinner meeting at the Miami Country Club, Miami Springs, Fla., December 5.

Mid-South—Jackson Branch dinner meeting at the Heidelberg Hotel, Jackson, Miss., November 12; Memphis Branch dinner meetings at Dobbs House Restaurant, Memphis, Tenn., November 18 and December 16.

Oklahoma—Annual meeting at the Student Union of the University of Oklahoma, Norman, Okla., November 30.

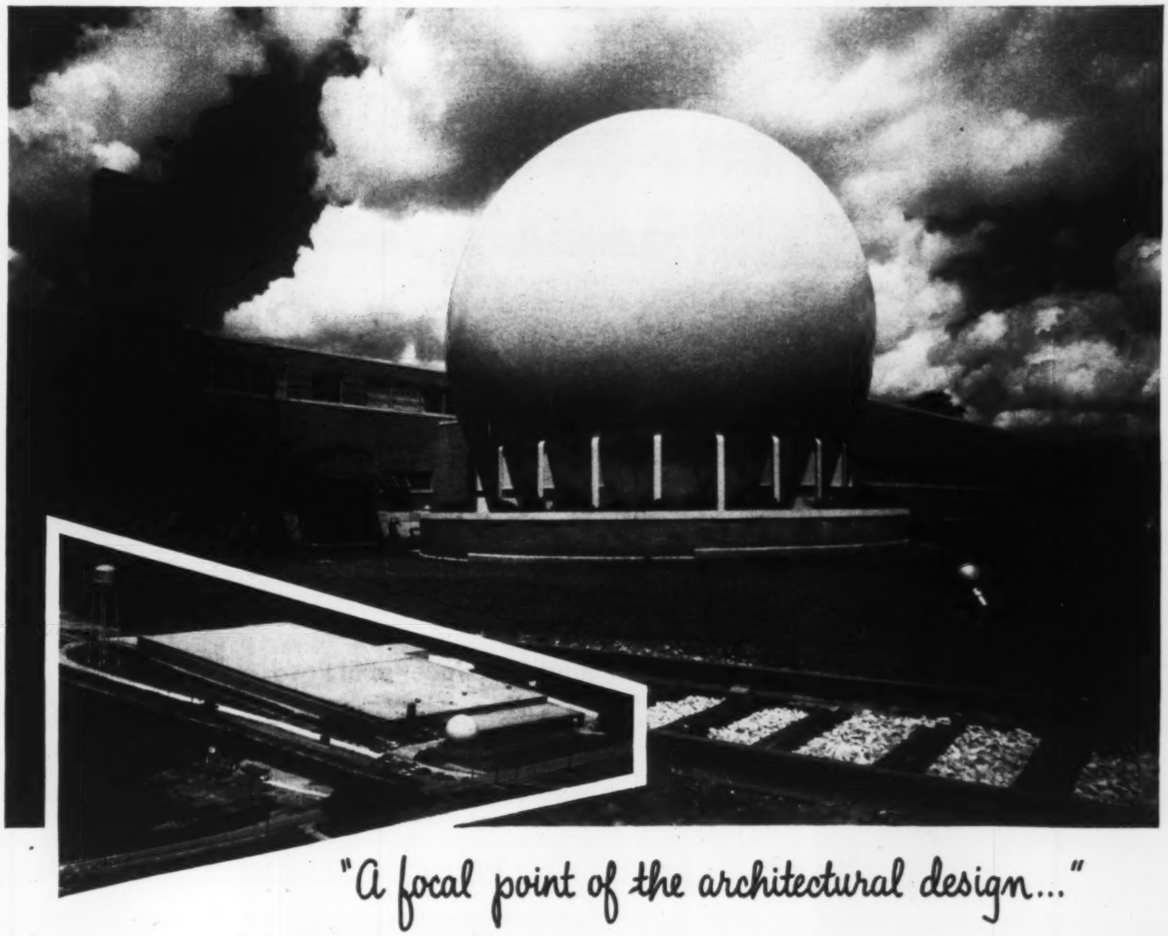
Philadelphia—Dinner meetings at the Engineers Club on the second Tuesday of each month. Meetings of the Division of Hydraulics and Sanitary Engineering at the Engineers Club on the third Thursday of September, November January, March and May. Central Pennsylvania Branch dinner meeting at Bucknell University, Lewisburg, Pa., November 13.

South Carolina—Northwest Branch dinner meeting at Hinton's Restaurant, Greenville, S. C., November 25.

Tennessee Valley—Holston Branch dinner meeting at Ridgefields Country Club, Kingsport, Tenn., November 21; Holston Branch Christmas Dinner for Wives at Ridgefields Country Club on December 19; Knoxville Branch dinner meeting at S & W Cafeteria, Knoxville, Tenn., December 11.

Wisconsin—Dinner meeting at the ESM Building, Milwaukee, Wis., November 21.

200,000-gal. Horton Spherical Water Storage Tank



"a focal point of the architectural design..."

at Waxdale

• A 200,000-gal. Horton® spherical water storage tank, used to supply the plant sprinkler system, was chosen for Waxdale, Johnson Wax, Inc. Shipping Center at Sturtevant, Wisc. According to J. P. Halama, Johnson's Staff Architect, "We decided to make the reservoir a focal point of the architectural design and therefore, chose a sphere because of its aesthetic value." In addition, a 100,000-gal. Horton elevated tank was also installed to provide dependable *gravity* pressure water supply.

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An impressive list of speeches and speakers was on the agenda of the **North Carolina Section's** annual meeting held in Raleigh on October 4. After a preliminary business meeting, A. C. Menius, head of the Physics Department at North Carolina State College, spoke on Nuclear Power Plants. North Carolina state highways were discussed by W. F. Babcock, director of highways for the State Highway Commission. The "Role of the Conservation and Development Department in Industrializing North Carolina" was considered by Miles J. Smith, first vice-chairman of the Department's Board of Directors. After luncheon, E. Stuart Kirkpatrick, assistant to the ASCE Secretary, spoke on the "Technical Activities of ASCE." Slated to preside over the Section for the coming year are L. E. Wooten, Sr., president; W. F. Babcock, first vice-president; Thomas Noe, second vice-president, and C. R. McCullough, secretary-treasurer.

"Recent Progress in the Concrete Pipe Industry" was the subject of an interesting speech delivered to members of the **Northwestern Section** at a recent meeting. Speaker of the evening was John G. Hendrickson, research engineer of the American Concrete Pipe Association of Chicago. A color film on Pipe Maintenance prepared by the city of Long Beach was also shown.

Late in the summer, the **South Carolina Section** held a big meeting in conjunction with the South Carolina Society of Engineers. The program included a business meeting, luncheon, inspection tour of Clemson College and an evening banquet. There is good news for the **Central Savannah River Branch** of the **Georgia Section.** Members of the South Carolina Section approved the request of the Branch to form a Section in its area composed of several counties in South Carolina and Georgia. ASCE Director Graham P. Willoughby outlined recent Board actions.

Freeway design and construction were spotlighted at the first fall meeting of the **Spokane Section,** when Donald Stein, recently appointed district engineer for the State Highway Department in Spokane, delivered an informative talk on the subject.

Total Membership as of October 9, 1957

Members	9,720
Associate Members	13,140
Junior Members	17,324
Affiliates	75
Honorary Members	46
Total	40,305
(Oct. 9, 1956	39,060)

Civic interest runs high in the **Toledo Section** which devoted its September program to consideration of local problems. City Manager Russel Rink discussed the history of the City Manager-Council form of government, and pointed out the advantages of the system. In the animated discussion that followed, Mr. Rink answered questions on current civic problems.

Three Sections in Southwest Meet at El Paso

The El Paso Branch of the Texas Section played host to the joint meeting of the Texas, Mexico and New Mexico Sections late in September. The colorful three-day meeting, by turns festive and serious, was held in El Paso under the chairmanship of Joseph Friedkin.

President Mason Lockwood presents Award of Honor in behalf of the Texas Section to Victor M. Ehlers of Austin, in recognition of Mr. Ehlers' lifetime of professional service as head of the Sanitary Engineering Division of the Texas State Department of Health.

In deep conversation at recent Tri-Section meeting, President Leopoldo Farias of the Mexico Section; ASCE President Mason Lockwood; Ray J. Foss of the New Mexico Section; and President Walter Moore of Texas Section.

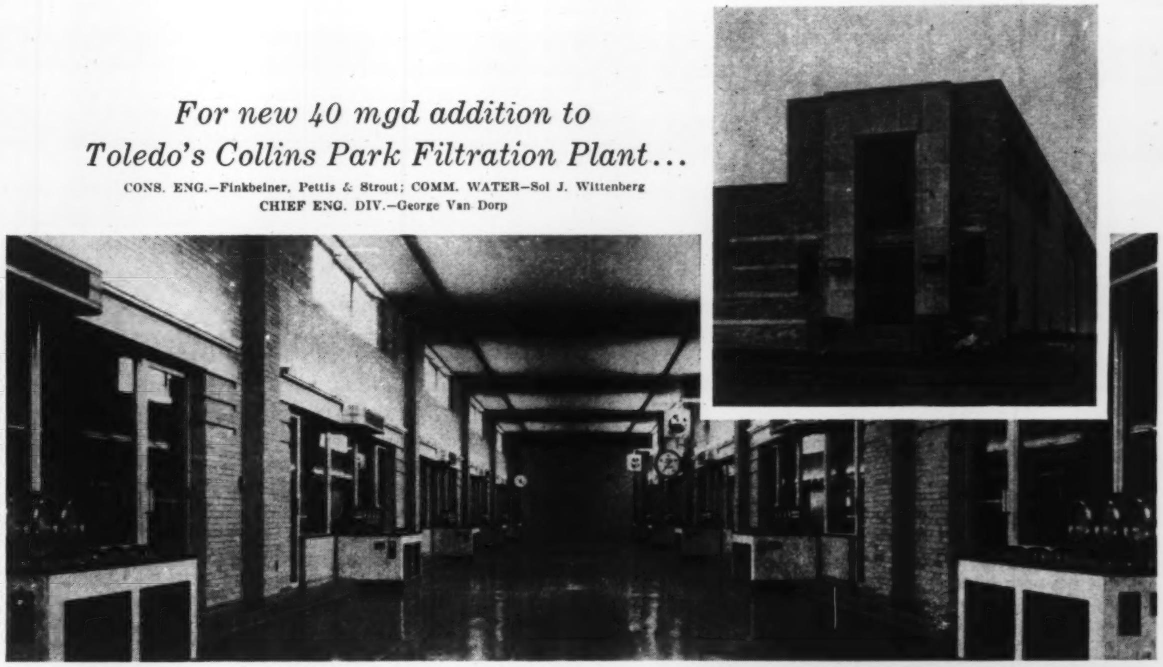
Running through the meeting was the central theme of "The Engineer and His Relationship to Highways and Water Problems." Many fine technical papers and talks on water and highway problems were presented by representatives of the International Boundary Commission, the Bureau of Reclamation, the Corps of Engineers, the Mexican Construction Department, and the state highway departments. An attendance of well over 100 heard the two keynote addresses on: "Water Problems of Texas," given by J. E. Sturrock, general manager of the Texas Water Conservation Association of Austin, and "The Grand Plan for Rebuilding the Nation's Highways," presented by J. C. Dingwall, engineer manager for the Texas Turnpike Authority in Austin. President Lockwood made a "Report to the 'Peepul'."

On the last day of the meeting, new Texas Section officers were installed. On the slate for the coming year are Uel Stephens, Fort Worth, president; Willard Simpson, San Antonio, vice-president; and Edmund Segner, Bryan, secretary-treasurer.

The social highlight of the joint meeting was "La Fiesta," held in Juarez. Cocktails, dinner, a dance and floorshow and much fun were on the agenda.

For new 40 mgd addition to
Toledo's Collins Park Filtration Plant...

CONS. ENG.—Finkbeiner, Pettis & Strout; COMM. WATER—Sol J. Wittenberg
CHIEF ENG. DIV.—George Van Dorp



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34 years of accuracy. No troubles. That's the service record of Simplex filter controllers, venturi tubes and meters at Toledo.

Dependable accuracy like this is essential to your plant, too. So take a closer look at Toledo's experience with Simplex:

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1941 – New Collins Park Plant selects: 40 Simplex Rate Controllers. (Also Simplex W. W. controllers; 60″ Venturi Tubes & Meters; plus Gauges & Meters.)

And again in 1956 for Toledo's expansion to 120 mgd—it's 100% Simplex with integrated Pneumatic Master Control. Equipment chosen: 20 Rate Controllers; 60″ Venturi Tubes and Meters; Gauges; Wash Water Controllers.

Efficient performance—with minimum maintenance—saves money throughout the years. That's why it's wisest for budget-conscious communities to start with the best.

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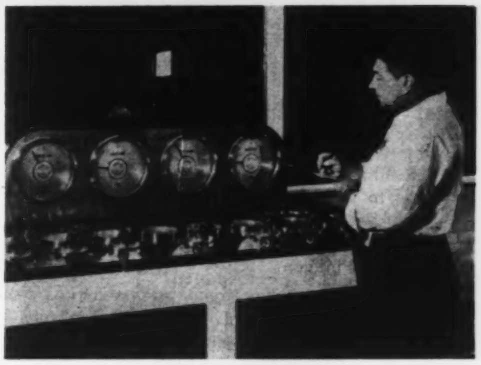
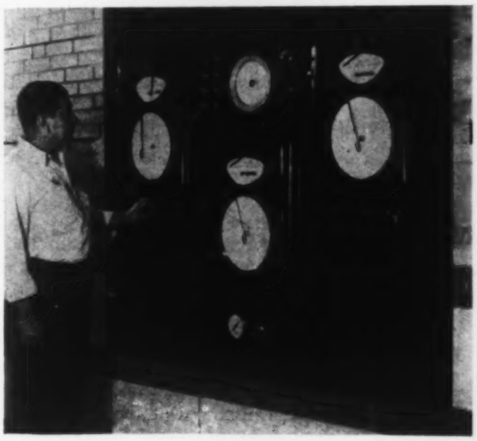


▲ Compact group of easy-to-read Simplex gauges indicates rate and head loss for a pair of the 20 new 4-mgd each filter units

▼ Part of the Simplex Pneumatic Master Control System that permits varying the rate of ten new filters from one location. This panel indicates, summates and records flow of raw, wash and filtered water



BY-LINE WASHINGTON . . . . .

(Last month, "By-Line Washington" started a review of legislation affecting the construction industry and engineering profession which was passed by Congress before adjournment. Here is what happened—(or didn't *happen)—to highway, military, pollution control and other construction bills.)*

Many of the bills affecting construction gathered dust in committee rooms during the last session.

There was no significant highway legislation. Moves to expand the 41,000-mile National System of Interstate and Defense Highways by 7,000 miles were evaded. The much-discussed bill to ban billboard advertising along the big network died in committee. This is the off-year for highway legislation, anyway, and Congressmen felt that recommendations to refine the federal-aid program could wait until the next session when the scheme will be scheduled for a major reappraisal.

The $1.4 billion Omnibus Rivers and Harbors Bill is also stalled in midstream. The Senate passed the measure but the House leadership held it up, possibly because of the danger that Eisenhower would veto it again.

The beleaguered Lease-Purchase program died in the Senate after a lingering struggle and a House vote to extend it with new governing provisions. Supporters plan now to push for direct appropriations to construct the 148 federal government buildings already OKed under the L-P scheme. Officials estimate their cost at more than $750 million.

The one-year-old federal grants-in-aid program for water pollution control construction took a 10 percent trimming, not a big cut considering that the program has not yet become entrenched.

Hardest hit was military construction. The Defense Department cut its budget twice before Congress took over and trimmed both the appropriation and the authorization bill (the former to $1.5 billion; the latter to $1.2 billion).

The revised "bid-shopping" bill which had finally won the united support of both general and subcontractors was tripped up in the Senate when the plumbing contractors bolted the industry ranks. They protested a provision that the new regulations would not extend to work 5 ft beyond the building line.

Urban renewal projects got a shot in the arm, however. Congress authorized $350 million to carry on these jobs after a barrage of appeals from municipalities for continued federal assistance.

* * *

Cost estimates for the biggest test road ever designed have risen again. The experiment at Ottawa, Ill., to measure the effect of various truck loads on various pavement and bridge designs originally was supposed to cost $12 million. Recently the Highway Research Board, which is conducting the traffic test, announced that unique construction features will bring its cost to $21 million. Although dismayed at the unexpected increase, the research engineers are confident that the project will be well worth every cent. The test is expected to influence the entire structure of highway design theory and have a profound effect on the philosophy of truck taxation.

* * *

Plans for construction of two of the Atomic Energy Commission's proposed nuclear power plants took a nose dive last month, when companies which had asked for the work suddenly boosted their estimates sky-high. Congress had just agreed to pay the cost of the projects. The firm, which had sought to build a reactor for a Minnesota rural co-op association, jumped its price from $5.7 million to about $8.7 million. The firm, which had offered to build a plant for a co-op in Michigan, upped its price from $5.5 million to $14.4 million. Both outfits claimed that rising construction costs were responsible for their re-evaluation, not the fact that Congress had agreed to let Uncle Sam pick up the tab.

* * *

Stumping the country this month, a House Committee on Intergovernmental Relations is taking the public pulse on the subject of federal aid to the states for highway, school, sewage plant, urban renewal, and airport construction. Federal-state relationships in these areas are being analyzed *again* with quite the same results as from previous inquiries. Governors, mayors, planners and engineers hurried to testify that Uncle Sam must stay in the picture. The committee has held or will hold hearings in Boston, New York, Chicago, Kansas City, Denver, San Francisco, New Orleans, Miami, and Raleigh.

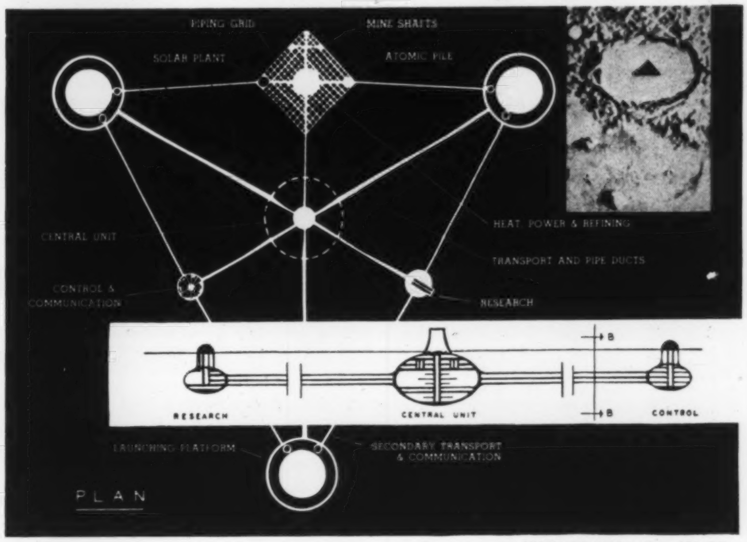
Back in Washington, another committee will probe the same problem this month. Headed by Congressman Wilbur D. Mills, the Joint Economic Committee will hear a number of economists and other experts give their opinions on how the big federal-aid programs affect the national economy.

The President gave impetus to these lines of inquiry with his proposal to the Governors' Conference recently that possibly some tax revenue sources might be relinquished to the states so they could assume some of these construction burdens themselves. A task force of federal officials and governors is exploring the idea now.

* * *

A permanent meeting ground for general contractors and subcontractors was created last month by the Associated General Contractors of America and the Council of Mechanical Specialty Contracting Industries. A new national joint committee representing both groups (combined membership, probably 20,000 contractors) will seek agreement on labor problems, specifications, insurance coverage and other issues of controversy between "generals" and "subs." A common problem to both is the increasing insistence of powerful industrial unions that management give plant construction or reconstruction work to company forces rather than to outside contractors.

MARS outstanding design SERIES



SCALE OF PLAN: 1" = 500 FT.

lunar base

Tomorrow's realities depend on research and imagination today. Both were used extensively in the planning of this lunar base designed by William G. Harvey, Jr. to accommodate space ships and travelers. The suggested location is "Aristotle," one of the craters near the north pole of the moon. Most of the base is beneath ground level to minimize temperature changes. Living quarters are spacious and recreational facilities include a swimming pool and basketball court. Power is supplied by solar plants during the day and atomic pile at night. Research, living and working areas are joined by monorail subway.

No one can be sure which of today's new ideas will become reality tomorrow. But it will be important then, as it is now, to use the best of tools when pencil and paper translate a dream into a project. And then, as now, there will be no finer tool than Mars—from sketch to working drawing.

Mars has long been the standard of professionals. To the famous line of Mars-Technico push-button holders and leads, Mars-Lumograph pencils, and Tradition-Aquarell painting pencils, have recently been added these new products: the Mars Pocket-Technico for field use; the efficient Mars lead sharpener and "Draftsman's" Pencil Sharpener with the adjustable point-length feature; and—last but not least—the Mars-Lumochrom, the new colored *drafting* pencil which offers revolutionary drafting advantages. The fact that it blueprints perfectly is just one of its many important features.

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MARS

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William G. Harvey, New York industrial designer, one of the winners in the 1957 MARS Contest. Mr. Harvey's project, "Lunar Base," is featured in the MARS presentation on this page.

MARS announces new design contest

The MARS Outstanding Design Contest of 1957 created such wide interest that MARS Pencils is sponsoring another contest for 1958.

If you are an engineer, architect or student, the MARS contest offers you a "showcase." It provides you with a valuable opportunity to have projects you designed shown in leading magazines where they will be seen by the men in your profession.

You are invited to send in your projects. For every submission that is accepted

MARS pencils will pay you $100

This $100 is paid you simply for the right to reproduce your project in the MARS Outstanding Design Series. There are no strings attached. You will be given full credit. All future rights to the design remain with you. You can reproduce it later wherever you like and sell or dispose of it as you wish.

The subject can be almost anything—aviation, space travel, autos, trains, buildings, engineering structures, household items, tools, machines, business equipment, etc. Projects will be selected on the basis of appeal to design-minded readers, broad interest, attractive presentation. Do not submit a design that is in production. In fact, the project does not need to have been planned for actual execution. It should, however, be either feasible at present or a logical extension of current trends. It cannot be unrealistic or involve purely hypothetical alterations of natural laws.

There is no deadline for entries but the sooner you send yours in, the greater the probability of its selection for the 1958 MARS Outstanding Design Series.

It is Simple To Submit a Design For Mars Outstanding Design Series

Just mail in an inexpensive photostat or photocopy of the subject—one you can spare, since it cannot be returned—and a brief description.

If your entry is accepted, we will ask you to send in a clear photograph or rendering of the design (so that we can make a sharp photograph) suitable for reproduction—after which your material will be returned to you.

Send your entry to:
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Hackensack, New Jersey

NEWS BRIEFS . . .

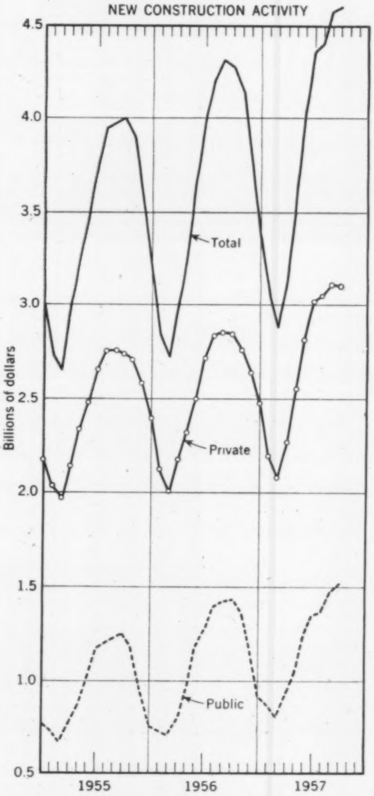
September Construction Rounds Out Peak Quarter

Outlays for new construction in September matched the all-time peak of $4.6 billion achieved in August, to round out the most active quarter on record, according to preliminary joint estimates of the U.S. Departments of Commerce and Labor. In September many important types of construction remained at or near the peak August levels, bringing the value of new work put in place during the first nine months of 1957 to $35 billion, 2 percent more than in the comparable 1956 period.

After adjustment for seasonal factors, this year's third-quarter total was at an annual rate of $47.4 billion, compared with a rate of $46.8 billion for the first half of 1957 and actual outlays of $46.1 billion for the whole year 1956.

Total private construction activity reached a new high in September, chiefly because of the major increase over the year in public utilities. Expenditures for new dwelling units ($1.1 billion) remained at the August level, and the decline from last year's spending on this work had narrowed from 14 percent in April to 8 percent in September. Although industrial construction continued the downtrend evident since last April, total expenditures for plant expansion during the first nine months of 1957 were still 7 percent above last year's comparable total.

Public construction continued to expand in September to a new high, principally because of small gains in highway construction, military facilities, and conservation and development work. For the latter, September outlays were slightly above the $100 million mark, reached for the first time in August. The major gains in the public sector for the first nine months of this year (10 percent above 1956) were primarily in state and locally owned projects—schools, highways, and sewer and water facilities.



September construction activity—at all-time peak of $4.6 billion set in August—rounds out record third-quarter total.

Dam in the Sierra for Southern California Edison

Construction of a large new dam, powerhouse, and storage reservoir—a major addition to the Southern California Edison Company's $164,000,000 "Big Creek" hydroelectric project in the High Sierra—is expected to start soon. Work will get under way as soon as approval of the Federal Power Commission and the California Public Utilities Commission can be obtained. According to James F. Davenport, executive vice-president of Southern California Edison, an agreement has already been reached with the Department of the Interior concerning the use of water from the proposed project.

Cost of the new facility is estimated at $49,600,000. Located on the upper San Joaquin River, in the mountains about 60 miles northeast of Fresno, the project will add 126,000 kw of generating capacity to the total of 540,000 kw now being produced by the company's "Big Creek" chain of lakes, dams, and powerhouses.

Featured in the development is a "Mammoth Pool" project, "which will add almost 25 percent to the production capacity of what has been called 'the hardest working water in the world,'" Mr. Davenport pointed out. The pool project will involve construction of a dam 950 ft long and 350 ft high across the San Joaquin; two small diversion dams across Rock Creek and Ross Creek; a reservoir with gross capacity of 123,000 acre-ft; a 20-ft-dia tunnel to carry water 8 miles from the reservoir to the powerhouse; and a two-unit powerhouse to be built in Madera County about eight miles downstream from the dam.

A large part of the runoff of the main San Joaquin River and its western and northern tributaries will flow into the Mammoth Pool for regulation, storage, and use. After developing power at the Mammoth Pool powerhouse, the water will be reused for the same purpose at the company's Big Creek powerhouses Nos. 3 and 4 farther downstream.

Niagara Falls Remedial Works Program Dedicated

Dedication ceremonies on September 28 marked completion of the Niagara Falls Remedial Works Program, undertaken four years ago to preserve the beauty of the falls while providing for more effective use of Niagara River water for power. Authorized in a 1950 treaty between the United States and Canada, the project has been carried out by the Army Corps of Engineers and Ontario-Hydro under the direction of the International Boundary Commission.

The program consisted of three principal parts: (1) Excavation of the channels on each flank of the Horseshoe Falls to draw water from the center; (2) crest fills to eliminate incidental flows over the extremities of the crests and permit flow of an unbroken curtain of water over the falls; and (3) construction of a dam to control the water level in the Chippawa-Grass Island Pool area. The fact that the program was completed for some $5,000,000 less than the original estimate of $17,500,000 is said to emphasize the value of the hydraulic model tests carried out in advance of construction. Articles on the Remedial Works Program appeared in the April 1952 and August 1957 issues.

Prominent government officials from both countries took part in the dedication ceremonies. The principal addresses were delivered by the Hon. Wilber M. Brucker, Secretary of the U.S. Army, and the Hon. Alvin Hamilton, Canadian Minister of Northern Affairs and National Resources.

AGC Board Acts on Construction Problems

Action was taken on a variety of matters affecting the construction industry at the largest midyear board meeting in the history of the Associated General Contractors of America, held in Seattle in September. More than 500 representatives of leading construction firms and most of the association's chapters and branches attended the sessions as guests of the Seattle and Mountain Pacific Chapters.

Important actions included the nomination of Vice-President Fred W. Heldenfels, Jr., of Corpus Christi, Tex., for president, and of James W. Cawdrey, of Seattle, as vice-president. Mr. Heldenfels is a member of Heldenfels Brothers, a leading highway construction firm, and Mr. Cawdrey is connected with Cawdrey & Vemo, a widely known building construction company. These officers and 27 directors will be elected by mail ballot and installed at the AGC's 39th annual convention in Dallas, February 10-13.

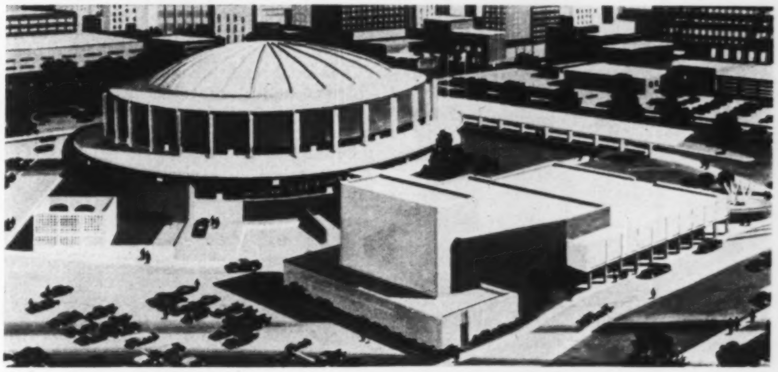
In presenting his midyear report, Executive Director James D. Marshall warned that contractors may face a "bad period" in spite of large construction volume. He listed as possible hazards inflation, tax demands, and "confusion" within the labor movement. He said that the association should remove as many of these hazards as possible and make the industry aware of those that cannot be removed.

In reviewing its labor attitude, the group reiterated the need for strengthening provisions in the Taft-Hartley Act banning secondary boycotts, and called for legislation to eliminate the "no man's land" existing in federal-state jurisdiction over unfair labor practice cases. It also recommended that chapters and members resist inclusion of any restrictive provisions in labor agreements.

Full cooperation with subcontractors was also approved. As a step toward cooperation, the group approved efforts to establish a national joint cooperative committee between AGC and the four major groups representing mechanical specialty contractors. In order to preserve the single contract method of construction, the boards also urged that general contractors "maintain complete responsibility for the [construction] project to insure an orderly progression of work, harmonious subcontractor relations, and maximum service to owners."

The AGC boards applauded the efforts made by the cement and steel industries to expand their facilities to alleviate material shortages and help meet the ever-expanding requirements of the construction industry. Cement supply is now adequate, AGC reported, despite the recent strike. Deliveries of heavy structural steel shapes and plates were reported to be on normal schedules in many areas.

Dallas Completes $8,000,000 Memorial Auditorium



Dallas' new $8,000,000 Memorial Auditorium was dedicated in recent three-day ceremonies playing up the construction innovations and the functional utility of the mammoth structure. Located on a 23-acre site near the heart of downtown Dallas, the arena section will seat nearly 11,000 under a cantilevered dome. A theater in a connecting wing will have room for another 1,800. The project features a suspended 204-ft-span domed roof and 45-ft reinforced concrete arms cantilevering from 70-ft-high bents or columns. Construction was described in two articles in the May 1957 issue of "Civil Engineering." The auditorium was designed by George L. Dahl, Dallas architect-engineer, and built by R. P. Farnsworth & Company, New Orleans. Consulting engineers were Ammann & Whitney, of New York.

Manhattan Waterfront to Have $18,723,000 Pier

Architect's rendering of new $18,723,000 square-shaped (805 by 810-ft) cargo and passenger terminal—to be built by the Department of Marine and Aviation along the Hudson at the foot of West Houston Street—is superimposed on an aerial view of the area. The Holland-America Line has just signed a twenty-year lease for the pier, which will accommodate four large ships at one time. Parking space for 725 automobiles will be provided on the roof of the two-deck terminal. Construction is expected to start this fall. Plans for the project were prepared by the New York consulting firm of Roberts and Schaefer, in cooperation with John M. Buckley, A.M. ASCE, Lewis H. Rabbage, Emil A. Verpillot, M. ASCE and Joseph Halpern, respectively consulting engineer, chief engineer, former deputy chief engineer, and present deputy chief engineer of the Department of Marine and Aviation.

AISC Honors Nine Outstanding New Bridges

Eight bridges in six states and one bridge connecting two other states have been chosen from seventy entries as the most beautiful bridges in the country opened to traffic in 1956 in the American Institute of Steel Construction's 29th Annual Aesthetic Bridge Competition. Stainless steel plaques will be affixed to the top winners in three classes, and certificates of honorable mention will go to the other six.

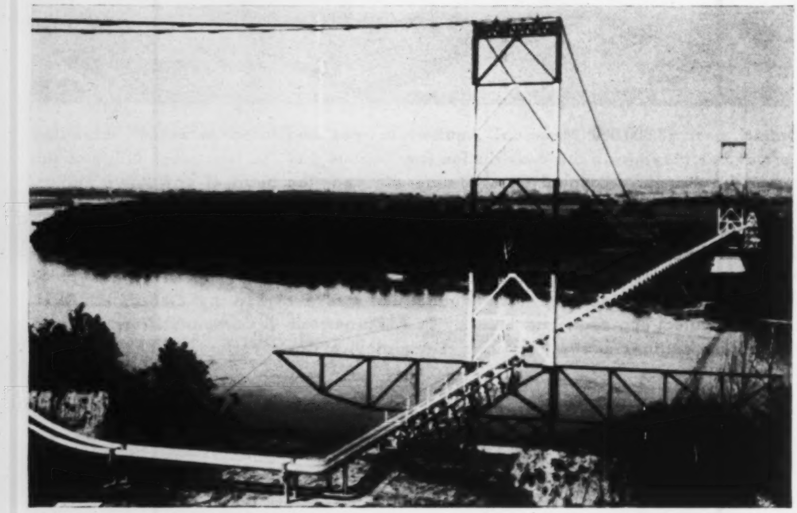
The jury made no award for the class entries under movable span bridges (Class IV), but designated two honorable mentions in this class. In commenting on the complete exhibit, the jury praised today's bridge designers "for their simple and direct solutions, good proportions, good taste, and excellent handling of their problems."

In Class I, for bridges with spans of 400 ft or more, the Missouri River Pipeline Suspension Bridge, at Plattsmouth, Nebr., was adjudged "best of show, and an outstanding example of an abstract design for a utilitarian purpose." This bridge was designed by Matthews and Kenan, and fabricated by the Pittsburgh-Des Moines Steel Company.

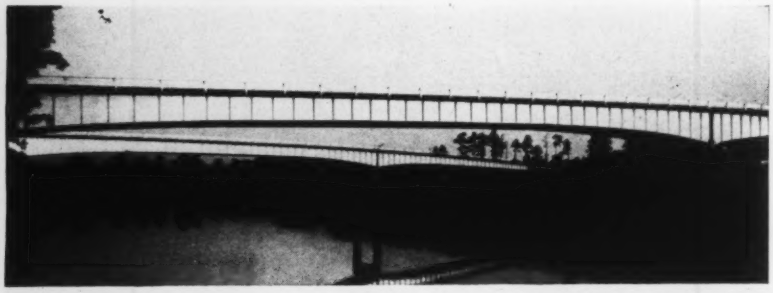
The Buffalo Bayou Bridge at Houston, Tex., is winner in Class II, for bridges with spans under 400 ft, costing over $500,000. The curvature of the long span appealed to the jury "because it transmits a feeling of lightness and grace." The Buffalo Bayou Bridge was designed by the Bridge Division of the Texas Highway Department, and fabricated by the American Bridge Division of U. S. Steel.

In Class III, for bridges with fixed spans under 400 ft and costing less than $500,000, top honors went to the Allegheny River Bridge at Salamanca, N. Y., designed in the Office of the Deputy Chief Engineer for Bridges, New York State Department of Public Works, and fabricated by Bethlehem Steel. The judges particularly commended the open guard rail on this bridge, which permits motorists a clear view of the river as they drive across.

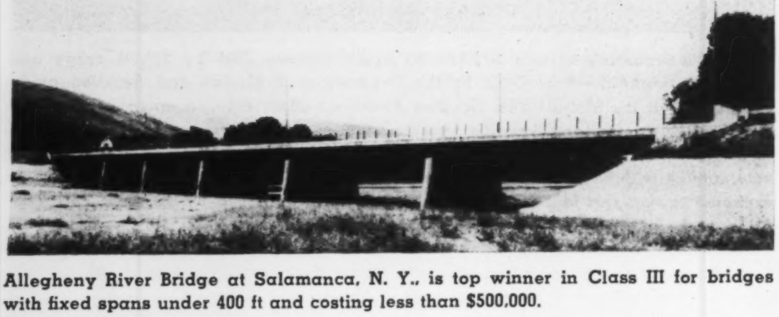
Honorable mentions, in Class I, go to the Delaware River Turnpike Bridge between Edgley, Pa., and Florence, N. J.; in Class II, to the Grass River Bridge at Massena, N. Y., and Thompson's Bridge near Gainesville, Ga.; in Class III, to the Corporal Joseph Thompson Memorial Bridge at Watertown, Mass.; and in Class IV, to the Algiers Lock and Canal Bridge at New Orleans, La., and the Sidney Lanier Bridge near Brunswick, Ga.



Missouri River Pipeline Suspension Bridge, at Plattsmouth, Nebr., is winner in Class I for bridges with spans of 400 ft or more. Jury called this bridge "best of show."



Winner in Class II, for bridges with spans under 400 ft, costing over $500,000, is Buffalo Bayou Bridge at Houston, Tex.



Allegheny River Bridge at Salamanca, N. Y., is top winner in Class III for bridges with fixed spans under 400 ft and costing less than $500,000.

Record Set in Steel Shipments

Shipments of finished steel products in the first eight months of 1957 totaled a record 56,392,714 net tons, the American Iron and Steel Institute reports. This output exceeds the former record of 55,432,982 net tons set during the same period of 1953 and the January-August 1956 total of 53.8 million net tons. Total August shipments of 6,229,853 net tons compared with August 1956 shipments of 5,539,915 net tons.

The five leading market groups receiving steel products during the first eight months of this year were construction (including maintenance and contractors' products); warehouses and distributors; automotive; containers; and machinery, industrial equipment and tools.

Civil Engineers Put Electrons to Work

Historic Boston was the setting for a recent meeting of civil engineers interested in using electronic computers and associated instruments to increase their output. The exhibits at the Fourth Conference on Increasing Highway Engineering Productivity, held September 17-19, showed how electronic devices can be used in highway computation and design, structural design, and surveying and mapping. Listening-in on the conversations that occurred around these exhibits, one wondered whether those who advocate teaching atomic physics and electronics to student civil engineers are as "off base" as some have implied.

In greeting the assembly of over 500 engineers, the governor of Massachusetts, Foster Furcolo, stressed the need for getting the Interstate Highway System off the drawing boards and on to the ground. It is apparent that electronic methods will help to accomplish that immediate goal.

Several themes dominated most of the presentations: The computers are not the "giant brains" that many press releases seem to indicate. They cannot make engineering decisions; they can only perform for the engineer the calculations that he is able to do himself in, however, a fraction of the time. The computer can only solve the problems that are presented to it in the form of a "program," which is a presentation of the problem in electrical language. To "write" the program, one must be able to understand and solve the problem.

Another important theme was a call for the establishment of a "library" or "pool" of programs. This is necessary to avoid duplication of the many hours of effort needed to develop a program. Pleas also were entered for the development of general flow charts rather than specific programs. Such charts would enable engineers with any computer installation to make use of the ground-breaking work done by another organization with, perhaps, a different installation.

The use of the new electronic devices must be "sold" to engineers. Such a selling program may consist of guided tours of a computer center, conferences, the solution of sample problems, and the like. It has been found difficult, in some cases, to keep an engineer from making extensive surveying computations, for example, because he enjoys the solving of this type of problem. He must be shown that his enjoyment is not worth the excessive number of hours expended.

Some of the computer programs that have been written include: (1) the design of continuous bridges and bents, (2) the design of skewed bridges on a horizontal curve in which the piers may be parallel or skewed, (3) cut-and-fill computations for both preliminary estimates and final payment, (4) computation of hydraulic backwater curves, (5) slopes and deflections of continuous beams, (6) traverse computations, (7) right-of-way calculations, and (8) suspension-bridge analysis by Fourier Series.

R. Glen Ryden, chief computer of the Arizona State Highway Department, revealed that the time saved in making only 6 miles of highway computations will pay one month's rent on a complete medium-sized computer installation. He also informed the audience that use of an electronic computer to perform highway and surveying computations does not require any change in the method of keeping field survey notes. However, he did request that field notes be made more legible so that card-punch operators can follow the data with a minimum chance of error.

During the series of meetings it was noted by Robert J. Hansen, J.M. ASCE, of the Washington (State) Department of Highways, that the department has been computing highway earthwork at the rate of 100 miles per month. Jerry C. L. Chang, principal assistant engineer for Richardson, Gordon & Associates of Pittsburgh, Pa., outlined the need for cooperation between those working on different problems on the same computer, on the same problem on different computers and, of course, on the same problem on the same computer. Only by such cooperation can engineers hope to make maximum and efficient use of this high-speed equipment.

The next topic covered was the use of photogrammetry as a tool for increasing highway productivity. C. Whitcomb, of the Massachusetts Department of Public Works, revealed that his department uses photogrammetric maps for preliminary and location surveys and for payment to contractors for earthwork. Alfred O. Quinn, A.M. ASCE, chief engineer for Aero Service Corporation, of Philadelphia, Pa., presented his company's method of making a photo-contour map. After the stereoscopically obtained contour manuscript sheet has been inked, the photographic processes begin. All the effects of distortion due to differences in elevation are eliminated by separately projecting and printing the photographs between adjacent contours in a step-by-step process. The final result is one that meets all accepted standards for contour maps, with the additional advantage of the elimination of topographic symbols to define objects which are, naturally, on the photograph.

Professors Charles L. Miller, J.M. ASCE, and Saul Namyet and D. R. Schurz then outlined an earthwork computation procedure that has been developed at MIT. This procedure consists of obtaining stereoscopic grid elevations from a stereo-plotter and recording the information in a digital computer. Earthwork quantities are then determined

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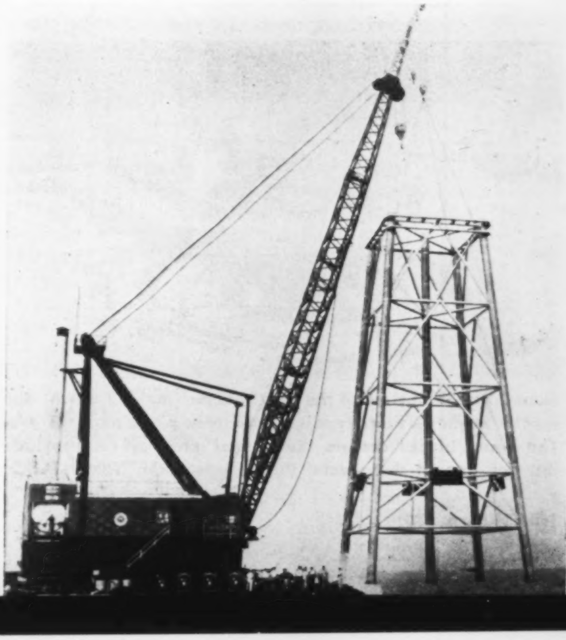
Aluminum Oil Drilling Platform Erected in Lake Maracaibo



World's first aluminum offshore oil-well-drilling platform is lowered into position in Lake Maracaibo. This prefabricated platform and three others currently being installed are said to be the largest all-welded aluminum structures ever built. The platforms range from 111 to 121 ft in height and are about 9 ft above water level. Each requires some 80,000 lb of aluminum. The units are attracting much attention in the oil industry because of their resistance to corrosion. They can be erected in from three to five days, and dismantled and moved to another location as new drilling operations require. The platforms were designed by J. Ray McDermott & Co., New Orleans offshore drilling contractors, assisted by the Reynolds Metal Company which advised on the problem of corrosion.

for any road alinement for which there are known the coordinates of the PI's, the radii of curvature of the horizontal curves, the tangent grades, and the lengths of the vertical curves. By use of this procedure, the earthwork quantities involved in numerous alinements can be studied within a short period of time.

The session devoted to electronic methods of surveying aroused much interest. It was explained—by Capt. John H. Brittain, M. ASCE, of the Coast & Geodetic Survey—how the Tellurometer could attain accuracies of 1/100,000 for lines up to 35 miles in length. The use of this electronic surveying instrument enables a survey party to measure a line 2 or 3 miles long in 20 or 30 minutes. Some survey parties have recorded as much as 78 miles of length measurements in a single day with equipment that can be carried by hand.

The last afternoon was devoted to sessions on construction equipment and contracting procedures, which aroused the most spirited discussion of the meeting. Julien Steelman, president of the Koehring Company and also of the American Road Builders Association, explained how capital expenditures and the element of risk in the construction-equipment field are making it necessary for the industry to go through a process of evolution rather than revolution. Several speakers then outlined the contractor's difficulty in working in adjacent states due to the variety of construction specifications encountered. For the construction of the Interstate Highway System, they urged the adoption of uniform specifications based on performance rather than method.

Groups sponsoring the conference included the Massachusetts Department of Public Works, Massachusetts Institute of Technology, the Association of Highway Officials of the North Atlantic States, the American Association of State Highway Officials, and the U.S. Bureau of Public Roads. Carl A. Sheridan, Massachusetts Commissioner of Public Works, was the chairman.

New Group Will Promote Modular Building Standards

Four leading building industry groups have joined forces to boost acceptance of a program designed to reduce building costs through adoption of a basic unit of measurement. The program got under way recently with formation of a Modular Building Standards Association. Cooperating in the venture are the American Institute of Architects, the Associated General Contractors of America, the National Association of Home Builders, and the Producers' Council.

At the organization meeting, C. E. Silling, of Charleston, W. Va., was elected president of the group. He is an architect and chairman of an American Standards Association's committee concerned with coordination of dimensions of building materials and equipment.

According to Mr. Silling, the objective of the new association is to promote acceptance of the principles of modular dimensioning standards in construction planning and in equipment applications. He noted that the adoption of the 4-in. module as the basic unit of measure would assist manufacturers in effecting economies by standardization, since they would not have to produce so many sizes.

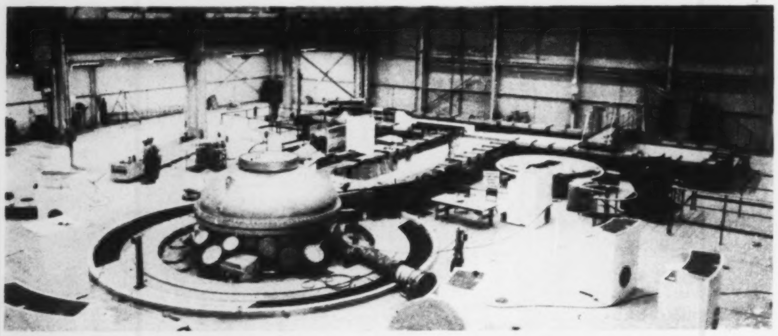
Adoption of the modular measure was first advocated by the National Bureau of Standards back in 1935. The movement has made considerable progress in both the United States and foreign countries since the end of the war.

Powerful Atomic Test Reactor Completed

An industrial preview of the Engineering Test Reactor—the world's most powerful instrument for the development of nuclear power—brought several hundred representatives of industry and the government to the U. S. Atomic Energy Commission's Idaho Operations Office at Idaho Falls early in October. The recently completed $14,000,000 facility, newest of the reactors at the National Reactor Testing Station, is considered a major development in the AEC program to advance construction of nuclear power plants for civilian and industrial use, and to convert aircraft and ships to nuclear propulsion.

The Engineering Test Reactor was pioneered by an adjacent Materials Testing Reactor, which has been in operation for the past five years. The new installation will be used principally to determine the effects of radiation damage on engineered components and materials, under conditions to be met in the nuclear power plants of the future. It went critical in September, 23 months after the start of construction.

The facility occupies eight acres on a 5,000-ft plateau within the National Reactor Testing Station. The largest single piece of equipment in the reactor is the pressure vessel—a three-story, 10-ft-dia cylinder of carbon steel clad with stainless steel—containing the uranium core with its experimental spaces. Although the reactor vessel is a precision instrument, it has an operating weight of 175 tons. It must be refueled every twenty operating days with from 26 to 44 lb of fully enriched uranium. The vessel is cooled by demineralized water circulating through it at 44,000 gpm.



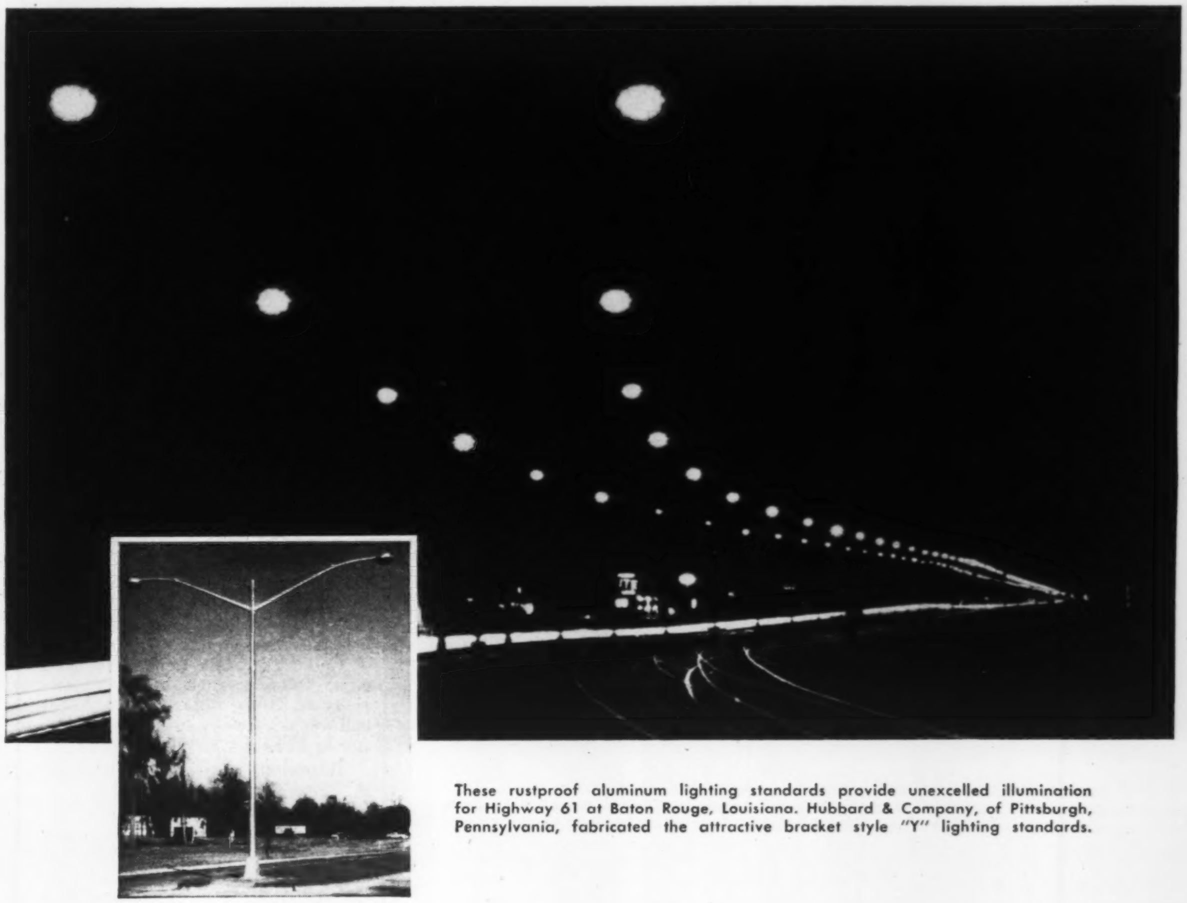
General interior view of the new reactor (looking down) shows the top plug of the reactor in place. Plate-type covers are in place over the experimental access holes. The white blocks around the reactor plug are the removable concrete shielding that fits around the reactor during operation. Official AEC photo.

High Multi-Purpose Dam Planned for Middle East

A private company headed by two former chairmen of the Tennessee Valley Authority, David E. Lilienthal and Gordon R. Clapp, has been authorized by the Iranian Government's Plan Organization to complete preliminary work on what will be one of the highest multi-purpose dams in the Middle East. The new company—the Development and Resources Corporation of New York City—also has been authorized to start work on four related agricultural and industrial projects for development of the vast Khuzestan region of southwestern Iran, the heart of the ancient Persian empire.

The dam, a high-arch concrete structure, will be built to a height of 460 ft in a deep mountain canyon on the Dez River about 150 miles north of the Persian Gulf. Estimated to cost $59,300,000, the project will be the first in a projected series of multiple-purpose river control structures to produce electric power for industry, store water for irrigation, and control floods. The Dez is the principal tributary of the Karun, chief river of Iran.

Plans for the dam include an under-



These rustproof aluminum lighting standards provide unexcelled illumination for Highway 61 at Baton Rouge, Louisiana. Hubbard & Company, of Pittsburgh, Pennsylvania, fabricated the attractive bracket style "Y" lighting standards.

Louisiana installs corrosion-free, maintenance-free lighting standards at no extra cost

Lighting standards of Alcoa® Aluminum are rapidly becoming the people's choice in every state of the Union. The reason? Their first cost is the last cost. Once installed, they provide years of maintenance-free service. Even under highly corrosive and moist conditions, aluminum stays rustproof, new-looking longer. It can never become an eyesore; it never requires a protective coating of any kind.

Because of their light weight, aluminum lighting standards cost less to ship and handle—they install easier and faster for additional savings in construction costs. Yet, these lightweights are heavyweights for punishment. They'll stand up in hurricane winds of 100 miles per hour and more. And, because interiors stay free from accumulations of rust and scale, they guard electrical circuits against short circuits and service interruptions.

Alcoa does not make lighting standards, but we can supply you with the names of manufacturers who do. For these names and any additional information that you might need about lighting standards of Alcoa Aluminum, write to Aluminum Company of America, 1979-L Alcoa Building, Pittsburgh 19, Pa.

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ground powerhouse large enough to house four 40,000-kw generating units (two of them to be installed initially). The dam will store enough water to irrigate 250,000 acres in the northern Khuzestan plain, an area about a quarter the size of California's Imperial Valley Irrigation District. It will be so designed that its height can, if necessary, be increased by 160 ft, which would provide irrigation for an additional 125,000 acres and bring generating capacity to a total of 520,000 kw. The entire project is scheduled for completion within the next four years.

At the request of the Plan Organization, the new company will carry out a long range resource-development program along TVA lines. W. D. Voorduin, M. ASCE, director of engineering for the Development and Resources Corporation, is in charge of surveys for potential dam sites on the Karum, Karkheh, Hindijan, and Jarrahi rivers.

Funds totaling more than $32,000,000 have been allocated by the Plan Organization for the work on the related agricultural and industrial projects.

Traineeships Awarded in Environmental Sanitation

Award of 77 graduate traineeships in environmental sanitation for the 1957-1958 school year is announced by the U.S. Public Health Service. Established primarily to bring new people into the field of public health, the awards were made to 32 sanitary engineers and others in 28 states and Alaska.

The traineeships are available to engineers, chemists, sanitarians, and allied professional personnel who wish to enroll for graduate study in public health. Applications may be obtained from any of the Department of Health, Education and Welfare regional offices, or from the Chief, Division of General Health Services, Bureau of State Services, U.S. Public Health Services, Washington 25, D. C.

Armour Institute Sponsors Structural Design Conference

Today's creative trends in structural design—the standard for tomorrow's buildings—will be explored at a National Construction Industry Conference, to be held at Congress Hotel in Chicago on December 11 and 12. The two-day program, covering forms, materials, methods and applications, will be sponsored by the Armour Research Foundation of Illinois Institute of Technology. The conference chairman is Dr. Robert L. Janes, A.M. ASCE, assistant manager of mechanical engineering at the Foundation.

Some 500 engineers and architects interested in structural design techniques and materials are expected to attend the conference, which will serve as a forum where leaders in the field can present to industry their current ideas and plans. Innovations in all phases of structural design will be featured.

The opening session, on December 11, will be concerned with air-supported shelters, hyperbolic paraboloids, thin shell structures, and cable tide structures. That afternoon there will be a session on materials, with the spotlight on concrete (prestressed and lightweight), structural sandwiches, fiber-reinforced materials, light metals, and new uses for timber. Methods, to be considered the morning of December 12, are ultimate design in concrete, models as analytical tools, ultimate design in steel, and computers. Applications, to be discussed that afternoon, include the Kaiser dome, Monsanto's plastic house, and computer methods.

The detailed program will be available from Conference Secretary J. J. Kowal, Technology Center, 10 West 35th Street, Chicago 16, Ill.

N. G. Neare's COLUMN

R. ROBINSON ROWE, M. ASCE

"Back safe and sound from the New York Convention, I see, Joe. Learn anything?"

"No, Professor. Mrs. Kerr was along, so we just conventioneered and sightsaw, except on Thursday when she went to the fashion show in the morning and shopping all afternoon and spent all our money and that night she wrote wish-you-were-here cards while I worked your jumping-frog problem and . . ."

"I was going to ask you about that."

"Well it wasn't as hard as it looked after I diagrammed it (Fig. 1). With 3 hops to the jump, Marksman always makes 15 ft in a straight line, but he hasn't much chance because each of the other 4 beats him half the time. Sidewinder, Hex and Quad each alternate between two possibilities, depending on whether their second deflection is in the same direction as their first. Leaving out Random for a moment, in 8 contests Hex would win 4, Quad 2 and Sidewinder and Marksman one apiece. So the real battle is between Hex and Random.

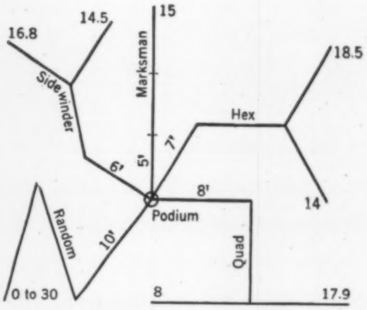

Fig. 1. Allowed 3 hops to the jump, terminal figures are radial distances from the starting podium for the 5-frog jumpathon.

"Now the way I look at it, Random hopping 10 ft aimlessly may jump 30 ft, or land back on the podium for no gain, or anything between. He averages only 15 ft to Hex's 16.25. There's less than half a chance of his beating Hex's bigger jump of 18.5 ft. So Hex wins."

"Here's our chance to see who learned the most in New York. Cal, do you accept or challenge?"

"I challenge. Joe's just as naive as Jim Smiley betting on Dan'l Webster full of quail shot. He overlooked the chance of Random winning when Hex is beaten by one of the other frogs. I can show that with a table (see below).

"This means, for example, that Random has a chance of .376 of beating Quad's jump of 17.9 ft, so that its frequency of .250 for winning in a 4-frog contest has to be split to .094 for Random and .156 for Quad in the 5-frog contest. From the totals, Random is the best bet, and a $2 mutual should pay $5.20."

"Wait a minute," begged Joe Kerr. "Where did Cal get those figures in the 4th column?"

"That's a nice question for next time," concluded the Professor. "Suppose you find the chance that Random jumps less than 10 ft and let Cal compute the same for jumps more than 20 ft."

[*Cal Klaters were Thatchrite (Guy C. Thatcher), Richard Jenney, Sauer Doe (Marvin Larson), David V. Messman, and DonT (Donald Thayer). Also acknowledged are solutions to the August problem from Messman and Ad L. Pate (G. H. Wilsey).*]

4-Frog Contest			Random Chance
Frog	Jump	Freq	
Hex	18.5	.500	.354
Quad	17.9	.250	.376
Side	16.8	125	.416
Mark	15.0	.125	.489
Totals	....	1.000	

Frequency for 5-Frog Contest

Rand	Hex	Quad	Side	Mark
.177	.323			
.094		.156		
.052			.073	
.061				.064
.384	.323	.156	.073	.064

Precast and prestressed concrete units manufactured and erected by:
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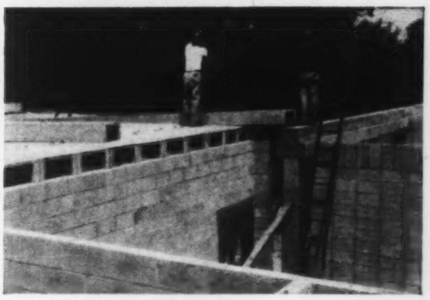
Contractor: N. J. Post Construction Co., Oaklyn, N. J.
Architect: Philip R. Soloway, Vineland, N. J.
Consultant Designers: M. Saphier Associates, Inc., New York City

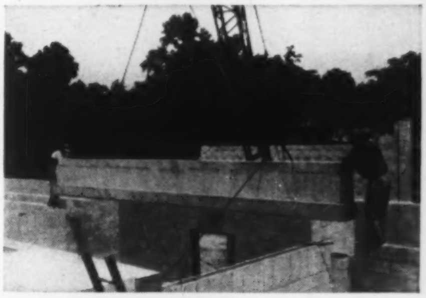

Placing one of the 440 "Clearspan" channels in the roof of the classroom building.

Precast concrete construction *throughout . . .*

The growing trend toward precast concrete is illustrated by this new Beth Israel Synagogue and School at Vineland, New Jersey. From standard concrete block to huge 60 ft. prestressed double tees, precast concrete serves both architecturally and structurally.

In precasting these units, the Edward Campbell Company used Lehigh Early Strength Cement for maximum production efficiency and economy. For example, in making the double tees, they used Lehigh Early Strength Cement and hot water curing. Result: early removal of units and reuse of forms in less than half the time required with regular portland cement.

This is typical of the advantages of Lehigh Early Strength Cement in modern concrete construction.


This inverted tee beam, 2'10" deep x 27' long, was especially cast for the job. Note extensive concrete masonry in common, stack and ashlar patterns. Load bearing walls include pilaster and bond beam block.

LEHIGH PORTLAND CEMENT COMPANY

ALLENTOWN, PA.

Rear view of classroom building shows variety of units used—concrete block, precast columns, cantilevered beams, window beams, lintels and cantilevered roof channels.

LEHIGH
HIGH EARLY STRENGTH
PORTLAND CEMENT

38 of these prestressed double tee roof beams (60' x 4' x 16") will form the roof of the synagogue.

News of Engineers

(Continued from page 33)

George D. Whitmore has been promoted from deputy to chief topographic engineer of the Geological Survey. Mr. Whitmore is widely known in mapping and surveying circles for his writings and activities in professional groups, including the ASCE Surveying and Mapping Division. He succeeds retiring chief **Gerald FitzGerald,** who has served in the post since 1947. Mr. FitzGerald joined the Survey in 1917 and has worked on a wide variety of surveying and mapping assignments in the United States, the West Indies and Alaska.

G. D. Whitmore

G. FitzGerald

H. F. Bahmeier, project manager for the U.S. Bureau of Reclamation in Grand Junction, Colo., has just returned to the United States after completing a 3½-year assignment to Australia as senior engineering adviser to the Snowy Mountains Hydro-Electric Authority.

Michael P. Superak has been appointed as the Austin Company's district engineer in Northern California. Since joining the firm in 1946, Mr. Superak has served as supervisory engineer and project engineer on a number of important projects.

Max Gleissner has been appointed chief engineer and assistant manager for Falcon Air Maps Co., of Denver, Colo. Dr. Gleissner recently retired voluntarily as chief of Field Surveys for the U.S. Geological Survey, after 39 years of service.

H. E. Hudson, Jr., has been admitted to partnership in the firm of Hazen and Sawyer, engineers of New York City.

Carl E. Roberts has returned to the U.S. Army Engineers after ten years' service with the Federal Power Commission at Fort Worth, Tex. He will conduct hydroelectrical power studies in the planning and reports branch of the Engineering Division of the Southwestern Division at Dallas.

Leonard L. Klein, manager of the Detroit office of Armco Drainage and Metal Products, Inc., has been appointed sales engineer for the Superior Products Company of Detroit. Mr. Klein will specialize in work with the firm's prestressed concrete division.

Guy Wilfred Hayler, civil engineer of San Francisco, Calif., and for many years planner and consultant to California and west coast cities, has presented a collection of plans, reports and other data on city engineering to the recently formed City and Regional Planning Library of the University of California at Berkeley.

Charles Pierce took office recently as assistant director of the Coast and Geodetic Survey, Washington, D. C. with the rank of Rear Admiral. Admiral Pierce has served the Bureau for 34 years.

Elwood Garrett, who has served in the Houston erection district of the Chicago Bridge & Iron Company, has been assigned to the New Orleans sales office. Mr. Garrett has worked in the Birmingham Shop and Birmingham Erection District.

Charles E. Schaffner has been appointed associate dean of the Polytechnic Institute of Brooklyn. Prior to his appointment, Dean Schaffner was professor of civil engineering and director of the college's evening school of sciences and engineering.

Frederick O. Diercks, Colonel, U.S. Army, has assumed his new duties as commanding officer of the Army Map Service of the Corps of Engineers in Washington, D. C. Colonel Diercks has spent most of his army career in topographic mapping and engineer intelligence assignments.

New officers of Prestressed Concrete Institute are, in usual order, Peter Verna, J.M. ASCE, secretary-treasurer; Ben Gerwick, Jr., M. ASCE, president; and Harold A. Price, M. ASCE, vice-president.

DECEASED

Robert King Brown (M. '24), age 92, retired civil engineer of Salt Lake City, Utah, died there on September 2. Mr. Brown went to Utah in 1903 to organize a maintenance-of-way department of the Los Angeles and Salt Lake Railroad, which he had served previously as division engineer at Los Angeles. He resigned this position to become superintendent and chief engineer of the Salt Lake and Utah Railroad. From 1929 to 1941, he was on the Utah State Building Commission—for part of this period as superintendent of construction. He then became a staff member of the Utah State Defense Council, serving as secretary of several of its committees.

Edwin William Byers (M. '40), age 60, Texas architect, died recently at a hospital in McAllen. Mr. Byers practiced architecture in New York, Illinois, and Michigan, before moving to Texas. His most recent work was for the Van Grove Realty Company in McAllen. Mr. Byers was educated at the University of Illinois and Northwestern University.

Arthur Culver (A.M. '13), age 78, engineer and agent for the Demolition & Construction Company, Ltd. of London, England, died recently in West Worthing, Sussex. A native of England, Mr. Culver had been with the firm for almost 20 years. Early in his career, his engineering work for various firms took him all over the world. He had worked for the Pennsylvania Railroad here and for the Buenos Aires Western Railway in Brazil.

Wayne J. Deady (A.M. '40), age 55, associate bridge engineer for the California Division of Highways, died at his home in Sacramento on July 19. Mr. Deady began his work with the design office of the Bridge Department in 1926, after varied engineering experience. Until 1949 he served as Sacramento resident engineer in charge of bridge construction projects, and was one of the key men on the department's construction force.

James C. DeGroot (A.M. '44), age 62, supervising manager of the Water Department of the Northampton (Pa.) Borough Municipal Authority, died recently in Northampton. An authority on water bacteriology, Mr. DeGroot had been in the post for 35 years. He had served as president of the Pennsylvania Water Works Operators Association, and chairman of the Pennsylvania Municipal Authorities Association.

(Continued on page 106)

INNER CIRCLES PROVIDE *Unique Sewer Recovery...*

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Inner Circles

Deceased

(Continued from page 104)

Walter R. Drury (M. '37), age 68, retired senior partner in the firm of Drury, McNamee & Porter, Engineers of Ann Arbor, Mich., died in Ann Arbor on August 19. Mr. Drury became a partner in the Hoad, Decker, Shoecraft & Drury firm in 1921, and advanced to the post of senior partner as the firm changed to Shoecraft, Drury & McNamee. Mr. Drury was a graduate of the University of Michigan College of Engineering.

John Harold Forsberg (M. '52), age 68, civil engineer for the Corps of Engineers in the Walla Walla (Wash.) District, died on September 11. Mr. Forsberg spent nine of his fifteen years in the Corps in the Walla Walla District, where he worked on the planning and design of various projects, including the McNary and Ice Harbor Lock dams. Mr. Forsberg spent the first 27 years of his career on various phases of railroad and logging engineering, and for a time maintained his own practice. He was educated at Stanford University and took in-service training at the AEF University in Beaune, France.

Samuel Hawes Gale (M. '45), age 53, chief engineer and special assistant to the resident member of the Board of Engineers for Rivers and Harbors and assistant to the Secretary of the American Section of the Permanent International Association of Navigation Congresses, Washington, D. C., died on September 5. Mr. Gale had served the Corps of Engineers since 1924 at Chattanooga, Kansas City, Los Angeles, and Albuquerque. He went to the Board of Engineers in 1944. Mr. Gale was educated at the University of Kansas.

Walter A. Grantz (M. '33), age 61, civil engineer with the Frederick Snare Corporation of New York, died in Stamford, Conn., on September 23. Mr. Grantz had been with the firm for 18 years—most of them with its subsidiaries in South America. Earlier in his career, he represented the Dwight P. Robinson Construction Company in South America. Mr. Grantz was a graduate of Cornell University.

Newton L. Hinkson (M. '54), age 44, vice-president of the consulting firm of Bleifuss, Hostetter & Associates, died at his home in Los Altos, Calif., on September 5. Mr. Hinkson was well known as a hydroelectric engineer, having spent more than 16 years of his engineering career in that field with the TVA, the Harza Engineering Company, the International Engineering Company, and the Bechtel Corporation. He joined the firm of Bleifuss, Hostetter & Associates in 1956. Mr. Hinkson was an engineering graduate of Kansas State College.

Gustaf Herman Jansson (M. '49), age 70, retired major in the Royal Corps of Engineers in Sweden, died in Stockholm on May 3. Major Jansson had charge of many important canal projects, including the Trollhatte, Hammarby and Sodertalje Canals. As chief engineer of the Stockholm Harbor Board, he had directed many bridge and harbor constructions. He was the author of a number of technical publications in both Swedish and English. Major Jansson graduated from the Royal Institute of Technology in Stockholm.

Leslie G. Jost (M. '37), age 70, retired president of Grady and Jost, consulting structural engineers of Los Angeles, died in that city on September 24. An authority on steel construction, Mr. Jost held responsible design and executive positions with the Llewellyn Iron Works, the Consolidated Steel Corporation, and the Los Angeles Building and Bridge Departments. He was a graduate of Acadia University in Nova Scotia, and an honor graduate of McGill University in Montreal.

Henry L. Kennedy (M. '49), age 60, sales manager of Dewey and Almy Chemical Company's Construction Spe-

(Continued on page 110)

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Men required: Two . . . *Training required:* One week . . . *Time savings over taping:* Greater than 50 man-days . . . *Time required for a measurement:* One hour (good visibility).

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Deceased

(Continued from page 106)

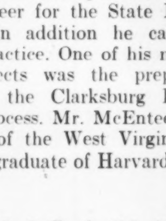
cialties Department, which he organized in 1929, died in Cambridge, Mass., on September 10. He had also taught at Wentworth Institute and lectured at Franklin Technical Institute and Harvard Graduate Engineering School. Mr. Kennedy, an internationally known authority on concrete, was long active in the American Concrete Institute, and was its president in 1953-1954. He was the author of many articles and papers on portland cement and concrete construction, and held the Herschel Award of the Boston Society of Civil Engineers. Mr. Kennedy studied architectural engineering at Northeastern University, and architectural construction at Wentworth Institute, and did graduate work in architecture at Beaune University.

Henry L. Kennedy

Frank Duff McEnteer (M. '21), age 75, bridge and highway consultant of Clarksburg, W. Va., died there on September 4. For many years, Mr. McEnteer was district engineer and construction engineer for the State Road Commission. In addition he carried on a private practice. One of his most important projects was the preparation of plans for the Clarksburg Expressway, now in process. Mr. McEnteer had been president of the West Virginia Section. He was a graduate of Harvard College.

Ernest H. Paffrath (M. '33), age 71, civil engineer of St. Louis, Mo., died on September 6. Mr. Paffrath had been St. Louis Sewer Commissioner from 1922 until the time of his death. He was the author of several well-known technical publications, including "Sewer Reconstruction and Sewer Maintenance."

Lowell O. Stewart (M. '41), age 62, writer, teacher, administrator, died at his home at Ames, Iowa, on August 24. Professor Stewart had served Iowa State College for 33 years—for 19 years as head of the department of civil engi-



Lowell O. Stewart

(Continued on page 112)

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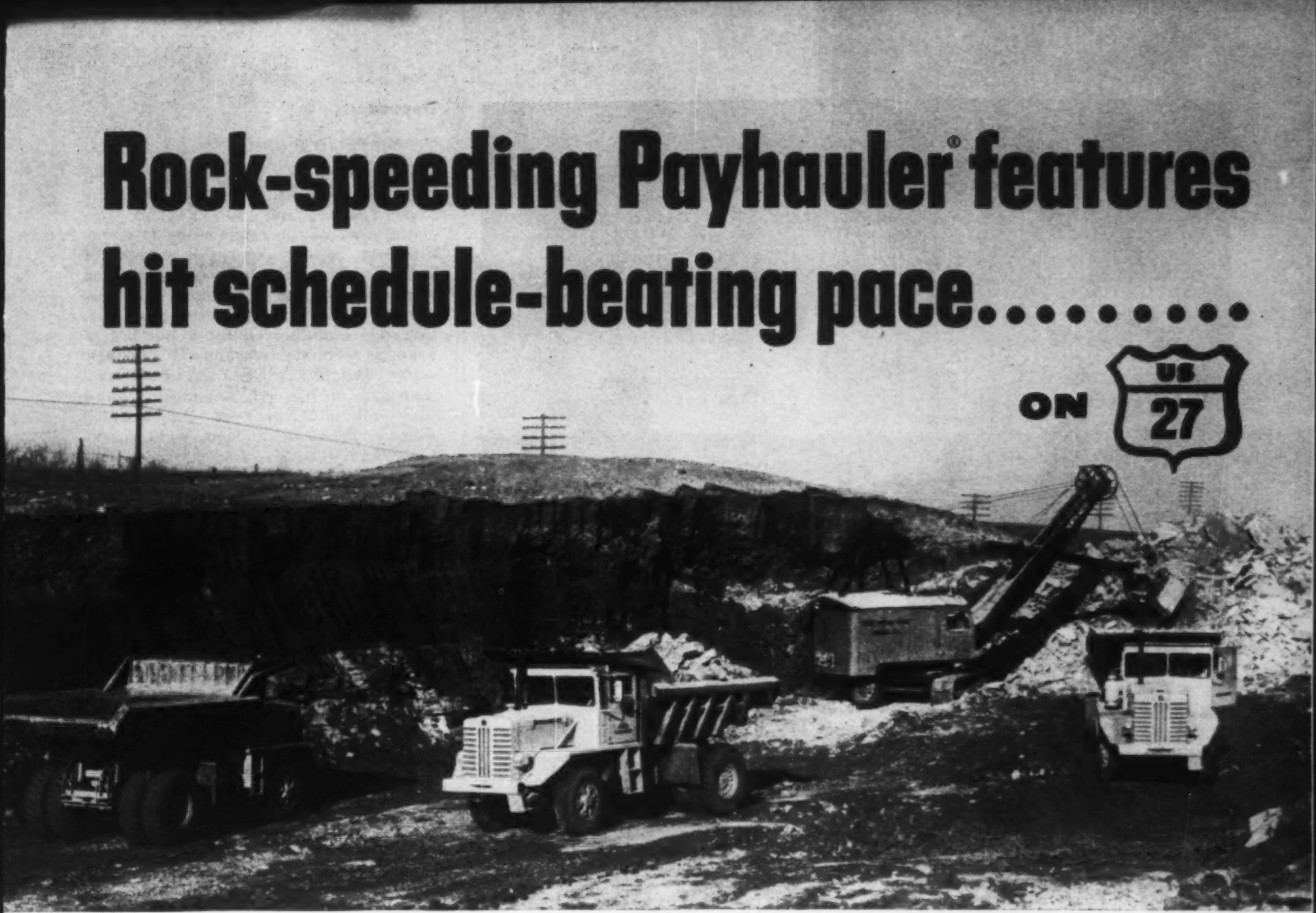

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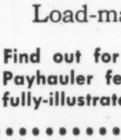

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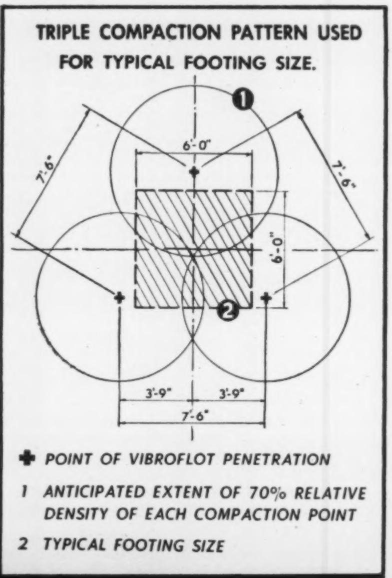
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Deceased

(Continued from page 110)

neering. During his professorship, he had been the first full-time engineering personnel officer, and, for a time, was acting dean of the Engineering Division. Professor Stewart was the author of many articles in the fields of engineering education, student counseling, and surveying. He was active in the Iowa Section, which he served for a number of years as secretary-treasurer. He was also active in the ASEE, and had been chairman of its civil engineering division and a member of the national council. Professor Stewart was on the Iowa State Board of Engineering Examiners from 1950 until his death. He received his B.S.C.E. from Michigan State University, and his M.S.C.E. and professional engineering degree from Iowa State.

Herbert A. Van der Goot (A.M. '43), age 48, civil engineer for the County Flood Control District, Los Angeles, died recently. Mr. Van der Goot was educated at California Institute of Technology.

New in Education

Brand New . . . The *College of the Pacific's* department of engineering will take its place this fall as the college's newest school. Engineering courses, offered since 1924 under a departmental system, will be incorporated into the expanded curriculum of the School of Engineering, under the able direction of Dean Adelbert Diefendorf, M. ASCE.

Cooperation . . . The need for cooperation between industry and the schools which provide its top men is being met by two programs. A Structural Engineering Conference on the Ultimate Strength Design of Concrete Structures was held at *Case Institute of Technology* on October 9, co-sponsored by Tech and the Portland Cement Association. *Carnegie Institute of Technology's* $24,350,000 development program is being directed by Benjamin Fairless, M. ASCE, president of the American Iron and Steel Institute, and Gwilym A. Price, president-chairman of Westinghouse Electric Corporation. Mr. Fairless reports that the industry-supported program has passed the $5 million mark in total subscriptions.

Engineering Scholarships . . . A different sort of cooperation between industry and education is announced by the Union Carbide Corporation which has established 268 four-year engineering scholarships at 48 schools. Their aim—to make college education possible for capable students who need scholarship support, to assure larger numbers of trained men and women for business and industry, and to give financial aid to a cross section of American colleges.

(Continued on page 114)

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Pre-fabricated "HYDROMAT" Asphalt Liners provide the ideal liner for all domestic, industrial and recreational facilities where the containment of water, wastes, sludges, brines, etc. demand a very efficient, economical and impervious lining material. "HYDROMAT" is quickly and easily installed as a monolithic liner with mechanically sealed joints . . will expand and contract with soil movements without rupturing or breaking the seal. Installed over (exposed) or under earth, concrete, gunite, steel or other materials . . . provides the practical answer to the problem of re-lining old, cracked concrete or gunite linings. "HYDROMAT" may be safely used for the containment of potable water in clear well construction and its ruggedness and durability permit its use as a fully exposed lining in large reservoirs to depths exceeding 50 feet. "HYDROMAT" is available in three thicknesses, 1/2", 1/4" and 5/32", in 4' widths and lengths up to 15' . . . longer lengths available on special request.

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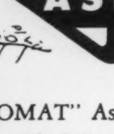

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New in Education

(Continued from page 112)

The Easy Way . . . A course in "Photogrammetry in Highway Practice" is being presented cooperatively by the Engineering Extension of the *University of California*, the university's Institute of Transportation and Traffic Engineering, and the California Division of Highways. It will cover the basic elements of photogrammetry—ground control, and the applications of photographs, enlargements, mosaics, reconnaissance and design mapping to highway engineering. A unique feature of the course is that it will consist of only three 3-hour meetings.

New Dorm . . . A new 300-man dormitory has just been completed at *Case Institute of Technology*. Ceremonies were held recently to dedicate Pardee Hall to the memory of the late Dr. James T. Pardee, M. ASCE, a Case graduate of 1888 who was one of the founders of the Dow Chemical Company.

Problems Aired . . . The U.S. Public Health Service sponsored a seminar on Air Pollution Problems at the *Robert A. Taft Sanitary Engineering Center* in Cincinnati from October 28 through October 30. Panel discussions touched on technical, educational and legal problems. A three-day seminar studied oxygen relationships in streams. Same place. Same time.

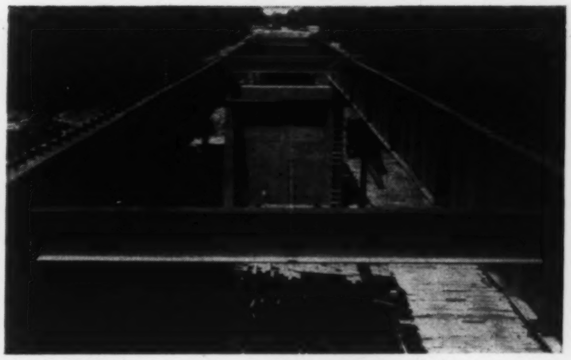
Moving Day . . . For the first time in its 103-year history, the *Polytechnic Institute of Brooklyn* will be located in new quarters. This fall more than three-fourths of the Institute's 5,900 graduate and undergraduate students will move five blocks north to the new site. The move represents the first major step in relocating one of the nation's largest schools of science and engineering.

Seabee Seminar . . . An engineering seminar was held at the U.S. Navy Construction Battalion Center in Davisville, R. I. as part of the base's 15th anniversary celebration. The seminar, devoted to "Economy in Foundations and Pavements," was attended by 126 engineers and construction men. Program moderator was Capt. Joseph P. Plichta.

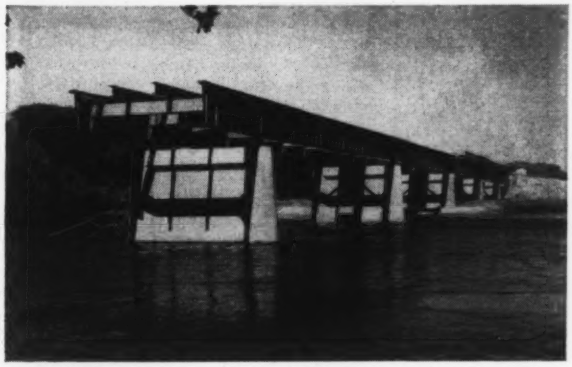
Back to School . . . This summer a select group of students was enrolled at the *University of Illinois* in a new program. The course was an Engineering Technician Training Program for high school graduates inaugurated by the university's department of civil engineering in cooperation with the Illinois Division of Highways and the Division of University Extension. During the 2½-month paid training period, instruction was given in college algebra, plane trigonometry, engineering drawing, surveying and highway materials. Tuition was paid by the Highway Division in return for the graduates' promise to work for the Division

(Continued on page 116)

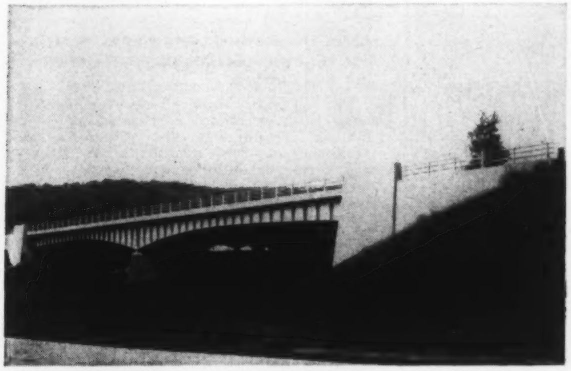
IN ARKANSAS—Plate girder bridge on Highway 62 over Spring River at Hardy. 1078′-2″ length, 26 foot roadway.



IN FLORIDA—Two span continuous girder bridge over the Suwannee River, 150′-150′.



IN IOWA—Continuous girder bridge over Cedar River, Linn County. Two 117 foot spans and six 150 foot spans.



IN CONNECTICUT—West River Bridge over Route 69 and West River. Continuous plate girder with 2 spans of 125 feet, 31 foot roadway.

Progress report on welded steel bridges

IN Connecticut, Iowa, Arkansas—all over the United States highway departments are taking advantage of the savings realized by welded construction.

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New in Education

(Continued from page 114)

for at least one year. The program was initiated in the belief that trained engineering technicians can carry out the state's expanded highway program.

Man's World? . . . For the first time in its ten-year history, the James F. Lincoln Arc Welding Foundation of Cleveland recognized a woman in its annual competition awards. The first grand award of $1,250 went to a husband and wife engineering team, Charles and Ann Hutchins. As undergraduates at the University of Michigan, they collaborated to submit an entry on the design of various parts used in a welded two-stage press. Second prize of $1,000 went to Eugene A. Jahnke and Keith Wilson, both enrolled at Iowa State. Third prize went to Donald Malcolm of Cornell. Duplicate awards in scholarship funds were presented to schools whose students received the main awards.

RECENT BOOKS

(added to the Engineering Societies Library)

ASTM Standards On Bituminous Materials For Highway Construction, Waterproofing And Roofing

Test methods, specifications, definitions of terms, and recommended practices relating to the field are compiled in a single volume for convenient use. As usual, a number of new and revised standards are included. A companion book for users of this publication covers mineral aggregates, concrete, and nonbituminous highway materials. American Society for Testing Materials, 1916 Race Street, Philadelphia 3, Pa., 1957. 448 pp., $4.75.

The Science Of Engineering Materials

Based on a series of lectures at Carnegie Institute of Technology in 1954 on the impact of solid-state science on engineering education, this book serves as a broad outline of this science which makes possible the development of improved and new engineering materials for specific engineering applications The transistor is cited as an example of such development. The six sections in the book edited by J. E. Goldman are: the structure of matter; metals and alloys; surfaces, magnetism and magnetic properties; semiconductors and dielectrics; and non-crystalline materials. John Wiley & Sons, Inc., 440 Fourth Avenue, New York 16, N. Y., 1957. 528 pp., $12.00.

Glossary Of Geology And Related Sciences

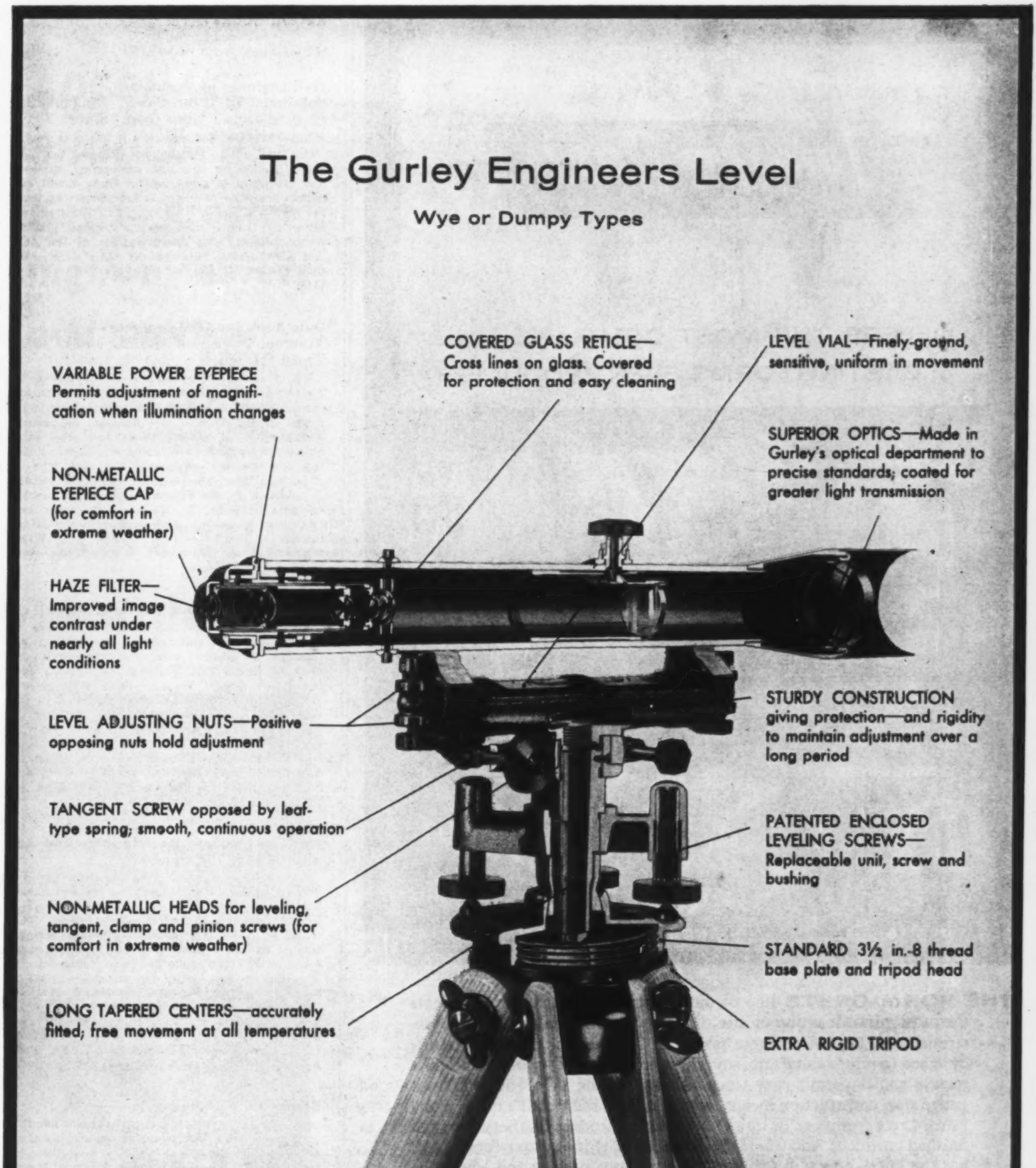
NAS-NRC Publication 501.

Prepared by a staff of nearly 100 specialists from 25 areas of geology and related sciences, this new glossary contains about 14,000 terms. Many terms commonly used in applied petroleum, mining, and engineering geology are included, as well as those used in theoletical geology and geophysics. Sources of most definitions are cited. The American Geological Institute, 2101 Constitution Avenue, N. W., Washington 25, D. C., 1957. 325 pp., $6.00.

(Continued on page 118)

The Gurley Engineers Level

Wye or Dumpy Types



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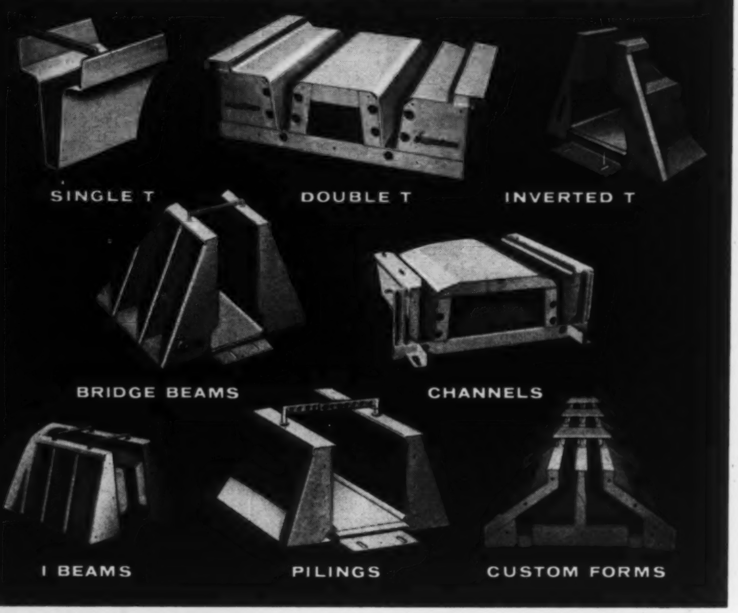

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Recent Books

(Continued from page 116)

Civil Engineering Problems

Solutions to Professional Engineering Examinations, New York State: Civil Engineering, Part III.

One of a series of pamphlets prepared by William Glendinning to assist engineering students and graduates in preparing for State Board examinations. The problems include concrete; timber and steel design and inspection; hydraulics; surveying; sewage and sewage disposal plants; water systems; and interpretations of the ACI and AISC codes. Published by the Author, 5123 Bell Boulevard, Bayside, N. Y., 1957. 72 pp., $3.00.

Data Book For Civil Engineers

Volume 2: Specifications and Costs; Third Edition.

Vol. 2 of this three-volume set by Elwyn E. Seelye, provides data necessary for preparing specifications for buildings, airports, roads, railroads, bridges, dams, docks, drainage, and sewers. Swimming pools, athletic fields, and other miscellaneous structures are briefly considered. Relative cost analyses are included for each type of work, and there is a classified glossary of terms. In addition to the extensive amount of practical data presented in this book, the other two volumes of the set provide similarly useful information on design and field practice. John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, N. Y., 1957. $20.00.

Earth Pressures And Retaining Walls

In this book W. C. Huntington discusses in detail the various methods of measuring earth pressures in cohesive and cohesionless soils and deals at length with problems of stability and foundation design. He also deals with general principles of the design and construction of retaining walls and presents practical methods for the design of solid gravity, semigravity, cantilever, and counterfort walls. The book has been written as a reference for practicing structural engineers and graduate students. John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, N. Y., 1957. 534 pp., $11.50.

Soil Construction; Its Principles And Application For Housing

The problem of using local materials to solve housing problems, particularly in the less industrialized countries, inevitably brings up the question of "stabilized earth construction". This report by S. Cytryn provides a detailed description of extensive research on all types of earth construction from adobe blocks to rammed walls. The research was carried out under the sponsorship of the U.N. Technical Assistance Administration. An appendix also describes experiments with light roofs of reinforced concrete for such buildings. Weizmann Science Press, Jerusalem, Israel; Interscience Publishers, Inc., 250 Fifth Avenue, New York 1, N. Y., 1957. 183 pp., $4.50.

Corrosion: A Compilation

A compilation of Mars G. Fontana's monthly columns on corrosion which appeared in *Industrial and Engineering Chemistry* over the past ten years. The chapters cover corrosion testing and evaluation, the nature, extent, and forms of corrosion, methods for combatting corrosion, corrosion in various environments and at high temperatures, and in connection with a number of resistant materials. An index is included. Press of Hollenback, 3134 North High Street, Columbus, Ohio, 1957. 240 pp., $5.95.

ASTM Standards On Thermal Insulating Materials

This volume is a special compilation of fifty-five specifications, methods of test, methods of sampling, recommended practices and lists of definitions covering insulating cement, batt and blanket, felt, block and board, and pipe insulation. A list of selected references is included. American Society for Testing Materials, 1916 Race Street, Philadelphia 3, Pa., 1957. 208 pp., $3.00.

(Continued on page 120)

ADEQUATE SHOULDERS: Key to greater highway safety and service

BITUMULS® DM-1 is applied by distributor.

BITUMULS Base Stabilization of Shoulders on New Jersey Route S-41

FIRST PULVI-MIXER follows closely behind distributor.

PNEUMATIC ROLLERS in tandem on initial compaction.

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● Typical of the speed and ease with which new safety and service can be built into existing highways is the work done last August along an eight mile stretch of Highway Route S-41, near Ellisburg, N. J.

Along each side of the 20 foot, rigid type pavement, a 10 foot width of sand-gravel base, 4 inches deep, had previously been placed and compacted to provide drainage. But it lacked stability, both under moving traffic and parked vehicles.

CONSTRUCTION METHOD

This in-place material was scarified, then bladed level. Over the loose scarified material, Bitumuls DM-1 was applied in two applications. Following each application, the material was mixed with two Pulvi-Mixers operating in tandem.

After mixing, the material was cut back to an even sub-grade line, then re-spread uniformly over the full 10 foot width. During blading and spreading, the mix had aerated sufficiently to allow immediate compaction. Pneumatic-tire rollers were used for initial compaction, with a final pass by tandem steel-wheel rollers.

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The shoulders were then thoroughly rolled.

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Inglewood, Calif. Oakland 1, Calif. Portland 7, Ore.

Recent Books

(Continued from page 118)

Basic Reinforced Concrete Design: Elastic And Creep

Second Edition, 1957

Using the problem method of instruction, this book by George E. Large contains a survey of the fundamentals of the subject for civil engineers. Following a chapter summarizing the making of reinforced concrete, the book considers beam flexure, beam shear columns, and continuity. Design procedures for beam, girder, two-way, and flat-slab floors are then presented. New material in this edition includes chapters on retaining walls, prestressed concrete beams, and creep, shrinkage, and ultimate strength design. A 90-page appendix provides much practical information. Ronald Press Company, 15 East 26th Street, New York 10, N. Y., 527 pp., $7.00.

Designing for Production

Primarily a textbook for engineering and technical students presenting fundamentals underlying the design and manufacture of a product that will be functionally sound, marketable, and profitable. Ferrous, non-ferrous, plastics, rubber, and synthetic rubber materials are described from the designers' viewpoint. Manufacturing information includes metal forming and shaping, metal cutting, joining processes, finishing processes, and packaging. Edward N. Baldwin and Benjamin W. Niebel are co-authors. (Richard D. Irwin, Inc., Homewood, Ill., 1957. 645 pp., $8.40.)

Calcul des Cuves des Chateaux D'Eau

A detailed treatment of the design of the tanks for reinforced-concrete water towers, particularly those bounded by surfaces of revolution (cylinders, cones, etc.). Both the theory and practical calculations are covered, with extensive use of monograms and other charts for simplified graphical treatment. Both vertical-wall and cantilever structures are considered by the author, Robert Gauthron. (Eyrolles, Paris, France, 1957. 216 pp., Fr. frcs. 4,040.)

Structural Design In Metals

Second Edition, 1957

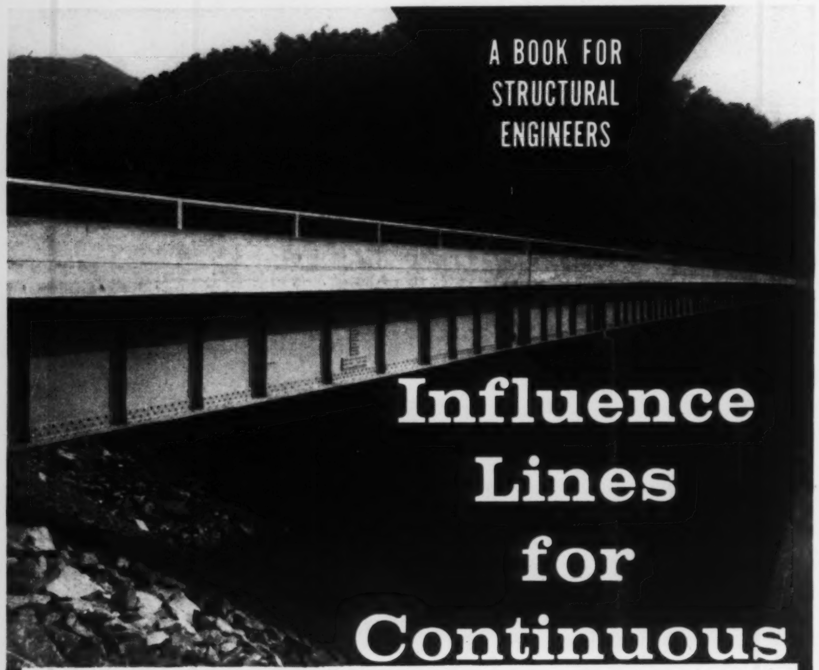
The new edition of this text for a first course in design by C. D. Williams and E. C. Harris, emphasizes basic training in the application of the statics of simple structures and the strength of materials to details of design. In the revision, additions have been made to chapters on rigid frame design and design with light gage metal, and recognition has been given to the use of other metals besides steel. Ronald Press Company, 15 East 26th Street, New York 10, N. Y. 655 pp., $8.00.

Beton Arme

Simplified calculations for the design of rectangular and T reinforced-concrete structural elements for both elastic and elastoplastic conditions are presented by the author, F. Touchet. Much of the data is in tabular form, with explanatory sections and numerical examples for a variety of simple and complex situations. The author's intent is to reduce the amount of work involved by the efficient use of known techniques. Librairie Polytechnique Ch. Béranger, Paris, France, 1957. 69 pp., Fr. frcs. 1900.

Library Services

Engineering Societies Library books may be borrowed by mail by ASCE members for a small handling charge. The Library also prepares bibliographies, maintains search and translation services, and can supply photoprint or microfilm copies of any items in its collections. Address inquiries to Ralph H. Phelps, Director, Engineering Societies Library, 29 West 39th Street, New York 18, N.Y.



(Tennessee Valley Authority)

Beams

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and JOEL I. ABRAMS, *Assistant Professor of Civil Engineering, Yale University*

Here is a new and immensely useful set of tables designed to save calculation time in the design of bridges. The tables in this book contain influence line data for continuous beams of two, three, and four spans having constant moment of inertia. In comparison with other data of this type, the domain of application has been greatly expanded. A wide range of unsymmetrical cases have been investigated and provide data of particular value in economic studies. In addition, influence lines for special points have been developed, providing data to investigate more accurately the occurrence of maximum positive moments under several conditions. Summary data are presented in each table, giving partial and total areas under the influence diagrams, as well as maximum ordinates for each function.

426 pages *8½ x 11* *Clothbound* $10.00

The Johns Hopkins Press, Baltimore 18, Maryland

Non-ASCE Meetings

American Association of State Highway Officials. Forty-third Annual Convention at the Conrad Hilton Hotel, Chicago, Ill., November 18-22. For information write the AASHO, National Press Building, Washington, D. C.

American Society of Mechanical Engineers. Annual meeting at the Statler and McAlpin Hotels, New York, N. Y., December 1-6. Information from the Society, 29 West 39 Street, New York 18, N. Y.

American Standards Association. Eighth National Conference at the St. Francis Hotel, San Francisco, Calif., November 13-15. Information from the Association, 70 East 45 Street, New York 17, N. Y.

Cleveland Engineering Society. Sixth Annual Construction Conference at the Society headquarters, 2136 East 19 Street, Cleveland, Ohio, on November 18. For information and reservations write the Cleveland Engineering Society.

Construction Design Conference. "Creative Trends in Structural Design," sponsored by the Armour Research Foundation of the Illinois Institute of Technology, at the Congress Hotel, Chicago, Ill., December 11 and 12. Details from the Armour Research Foundation, 10 West 35 Street, Chicago 16, Ill.

Council on Wave Research. Sixth Conference on Coastal Engineering at the College of Engineering, University of Florida, Gainesville, Fla., December 2-7. For information write the Council on Wave Research, Engineering Field Station, University of California, Richmond, Calif.

National Warm Air Heating and Air Conditioning Association. Forty-fourth Annual Convention at the Morrison Hotel, Chicago, Ill., November 21-22. For information write the Association, 640 Engineers Building, Cleveland 14, Ohio.

Applications for Admission to ASCE, Sept. 1-Sept. 28

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Rodger Bernard Collons, Baghdad, Iraq.
Martin Valdemar Engstrom, Evanston, Ill.
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Herman Gundlach, Houghton, Mich.
Howard Hugh Harris, Richmond, Va.
Fred Clarke Hobson, Charlotte, N. C.
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Martin Lang, Brooklyn, N. Y.
Laurence Edwin Lynn, Fort Leonard Wood, Mo.
Earl Howard Meyer, Tacoma, Wash.
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Harley James Morehouse, Ridgewood, N. J.
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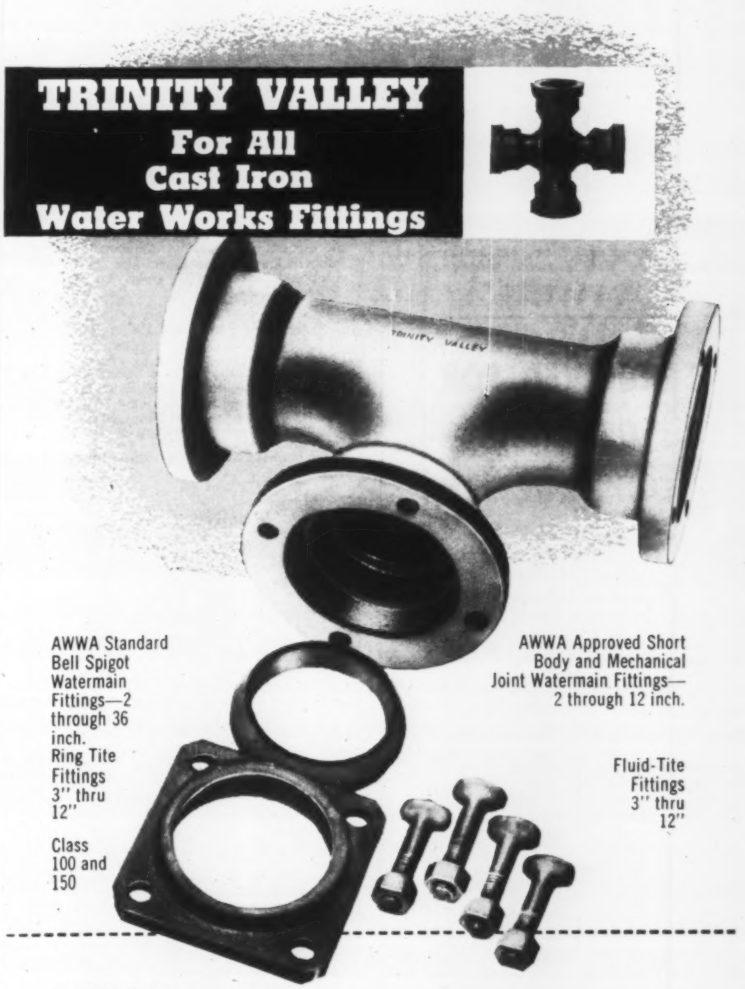

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Structural Engineer, J.M. ASCE; 26, M.S. in C.E., E. I. T.; some experience in highway construction, reinforced concrete and steel design, teaching of civil engineering subjects, and prestressed concrete research. 2 years' commissioned service in Post Engineer operations of U. S. Army with administrative and supervisory engineering experience. Speaks German. Any location. Overseas assignment considered. C-260.

Civil Engineer, J.M. ASCE; B.S.C.E.; 31; 2 years' design and construction of oil refineries, 3 years in Caribbean on design and construction of bauxite mining project, 1 year highway construction, 1 year surveying for consultant on subdivisions. Location desired: Foreign or Florida. C-261-468-San Francisco.

Civil or Hydraulic Engineer, A.M. ASCE; B.S.C.E.; 35; 10 years' experience in structures, sanitary, hydraulics as design, project and administrative engineer; 5 years' experience as estimator and engineer for small contractor. Will relocate. C-262.

Architect-Engineer, A.M. ASCE; B.S.C.E.; Certificate in Architecture, studying for M.S. in Management Engineering; 37; industrial construction since 1934. 7 years' as engineer and architect. P.E. and R.A. Project Manager, Group Leader, Designer; light to very heavy industrial, some residential and commercial. Location desired: New York or New Jersey. C-263.

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Junior Engineer, J.M. ASCE; B.S.C.E.; 25; 2 years with the Corps of Engineers, U.S.A. as a highway engineer dealing with large scale ground maneuver planning; seeks position with broad experience including sufficient engineering to obtain a P.E. license. Location desired: open. C-264.

Construction Executive, J.M. ASCE; 32; 10 years' experience, all phases commercial and industrial, bids thru completion from management level. Extensive experience government contracts, contract negotiations, sub contracts, owner-management-labor relationships. Desires permanent connection with opportunity for ownership participation. Location: West Coast, U. S. C-265-502-San Francisco.

Construction Engineer, A.M. ASCE; registered Professional Engineer; 52; 20 years' experience as supervising engineer on construction of industrial buildings, public buildings, bridges, airbases. 3 years as Air Force officer in charge of airbase and housing construction in Europe, and making site surveys and field reports at proposed construction sites. Location desired: Foreign. C-266.

Sanitary or Structural Engineer, J.M. ASCE; B.C.E., M.C.E.; 25; 2 years as instructor in fluid mechanics, strength of materials, materials testing and surveying, 8 months' research in trickling filter design and fluid flow. Graduate training in broad applications of civil engineering with emphasis on fluid and applied mechanics. Desires challenging position in research and/or design. Location desired: New York Metropolitan area. C-267-9390-Detroit.

Positions Available

Sales Engineers, 25-30, civil graduates, with concrete experience, for technical field work with customers of cement manufacturer. Salary, $4800-$6000 a year, plus expenses and company car. Location: Northeast. W-4600.

Principal Civil Engineer, graduate, licensed professional engineer and land surveyor or ability to qualify for same. 8 years' experience in municipal engineering, including 3 in a responsible supervisory capacity; some experience with building codes, zoning ordinances, etc.; thorough knowledge of modern engineering practices and procedures in the field of public works maintenance and construction. Under direction, will supervise activities of the engineering division. Apply by letter stating salary desired. Location: New Jersey. W-5312.

Structural and Civil Engineer with bridge design and highway experience. General consulting practice. Can lead to associate status. Man with well-rounded ability and interest takes precedence over highly specialized individual. Location: central New Hampshire. W-5338.

Field Promotional Engineer, graduate civil or architectural, with little or no experience, and a knowledge of structural steel construction. Duties will consist of promotional field work in uses of steel. Should be able to discuss design problems encountered in structural steel; be interested in promotional work and present subject well. Salary, $6000-$7500 a year. Employer will pay placement fee. Location: Chicago, Illinois. W-5343-C-6429.

Construction Superintendent, 35-50, preferably civil graduate, with at least 10 years' supervisory experience in heavy construction and building fields. Salary, $8000-$10,000 a year plus bonus. Location: Hawaii. F-5356-S.

Engineer, degree in civil or mechanical engineering, to 35, with 5 years' general engineering and construction experience; to handle projects from initiation thru estimate design, materials ordering and construction for expansion of new facilities as well as alterations and revisions to existing facilities; make analysis and study of operating requirements for proposed projects; develop basic designs, etc. One year separation if married. Salary, $7700-$10,200 a year. Location: Far East. F-5364(*a*).

Assistant Professor in Civil Engineering, for courses in mechanics and structures. Opportunity for research and summer work. Also openings for an instructor. Location: New England. W-5383.

Associate Civil Engineer, graduate, from 23, with 2 years of progressively responsible engineering office experience, for work in the engineering division of a department of public works. Under direction, will be in charge of division of office engineering and of sewage treatment plants; plan, assign and direct work of engineering office staff involved in preparation of designs, plans, cost estimates for maintenance and construction of streets, drains and sewage collection systems, etc. Salary, $6708 a year to start. Must be United States citizen. Location: California. W-5390-S.

Senior Soils Engineer with engineering training for soils investigation, testing, reports and assist in design and layout of structures, fills, cuts, piling and foundations. Salary, $7200-$8400 a year. Location: New York, N. Y. W-5394.

Soils Engineer, B.S. degree, for rolled earth dam—four million cubic meters. Will supervise 10-15 Turkish engineers and inspectors. Must have had at least 10 years' experience in soil mechanics including experience on inspection of earth dams. Prior experience in installation of embankments and piezometer equipment. Prefer single status but applicant may take wife and small family. Salary, $10,800 a year, plus allowances. Location: Turkey. F-5396.

Construction Engineer, 23-35, preferably with mechanical or civil engineering degree, but will accept individual without degree if sufficient experience; with degree, 2 years' construction drawing experience required; without degree, 5 years' experience. Will make building drawings, plant layouts and detail drawings as required for building construction and alteration. Plan and design process equipment such as glue systems, exhaust systems, material handling equipment, etc. Salary, $5400-$6600 a year. Location: Florida. W-5401(*a*).

Engineers: (*a*) Planning Engineers, graduates of accredited architectural or engineering school, or equivalent technical experience and training fully qualify as professional engineer; 5 years' experience in municipal and/or military installation planning; complete familiarity with, and experience in, USAF installations planning, airfield layouts, siting of structures, pavements, utility facilities, and master plan development. Salaries open. Contracts for at least one year. (*b*) Programming Engineers, graduates of accredited engineering, architect or business administration school, or equivalent technical experience and training to qualify as professional engineer; 3 years' experience in municipal and/or military installation planning, or 5 years' experience in marketing of engineering products; complete familiarity with, and experience in, USAF processes by which projects are placed in a program to include interpretation and guidelines for military construction programs and maintenance and operating programs, preparation of detailed justification for projects and presentation of programs. Salaries open. At least a one-year contract. Locations: Turkey and North Africa. F-5427.

STRUCTURAL
ENGINEERS
DESIGNERS
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Prefer several years' experience in any of these fields:

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BUILDINGS
EXPRESSWAYS
HYDRO PROJECTS
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Will consider lesser experience with good educational background. Several recent graduates will be added to our structural staffs to round out this planned expansion program. Occasional openings for combination men in construction supervision and inspection; must be free to move and to assume office duties between assignments.

Sverdrup & Parcel, Inc., are professional engineers engaged primarily in design work covering a wide scope of practice. The variety and unusual character of our work, including as an example the proposed world's largest bridge project, offer excellent opportunities for individual and professional development and advancement.

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Civil Engineers. (*a*) Construction Engineer, preferably graduate civil, experienced in office computations and quantities and all the detail work of a highway and bridge project. (*b*) Civil Engineer, graduate, to inspect reinforced concrete and steel for bridge work. Will lead to supervisory position. Salaries, *a,b*, $7200 a year. (*c*) Sanitary Engineer for design of sewerage plant and water supply problems. Must have background and ability to supervise. Salary, $8000 a year. Location: Connecticut. W-5441.

Architect and Engineers, professional degree, preferably registered, with 5 years' experience in their specialties in design of construction projects and preparation of working drawings and specifications, not including time as draftsman; thorough knowledge of economical construction methods; experience in preparing technical studies, criteria and standards. Salary open. At least a one-year contract. Locations: North Africa and Turkey. F-5495.

Construction Superintendents, with at least 10 years' supervisory field engineering and installation experience. (*a*) One mechanical; covering heating, piping, refrigeration and equipment. (*b*) One electrical covering communication, lighting and distribution. Salaries: $1,400 a month while in Greenland; $840 a month when in United States. F-5424.

Office Manager for foreign administration of a large contractor's office. Should have good knowledge of accounting, budgets, and costs. Knowledge of Spanish essential. Salary, $10,000 a year. Location: Europe. F-5476.

Resident Engineer to represent architect on outside building construction consisting of two large restaurants and two gas stations on expressway. Salary, $8000-$9000 a year. Duration, 18 to 24 months. Location: eastern New York State. W-5477.

Highway Engineer, graduate civil, to take over the design, soils work, etc. of a system of highways in a small country in the British West Indies. Salary open. F-5478.

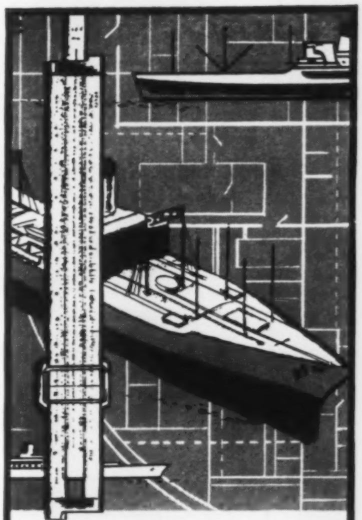
Manager of Technical Sales with experience in concrete mix design, inspection, construction and design or field experience. Sales and preferably sales management involving technical sales promotion. Will coordinate, manage and expand present sales force of company in the field of concrete admixtures and chemical specialties used in engineered construction. Salary open. Headquarters: New York Metropolitan area. W-5490-CD.

Engineers. (*a*) Project Manager. Location: North Africa. (*b*) Assistant Project Manager. Location: Turkey. Applicants should have following qualifications: Degree and registration in architectural, civil, mechanical or electrical engineering; 5 or more years' specialized engineering or architectural planning and 5 or more years' of managerial experience in architecture or engineering; thorough knowledge of economical construction methods; complete familiarity with all phases of engineering and management; complete familiarity with U.S. Air Force construction programs and methods, etc. Salaries open. At least a one-year contract. F-5494.

Sales Engineers for a major steel company, 25-30, with engineering background and a desire for sales work, to promote and sell fabricated products. Attractive starting salary with company car, expenses and bonus plan. Territory: Middle Atlantic states. W-5501.

Water Power Engineer to head group engaged in investigations, economic studies and designs of hydroelectric, flood control and water supply projects. Experience in earth and concrete structures, tunnels, control works, etc., mandatory. Must be willing to travel as required. Location: Southwest. W-5526.

Civil Engineers for consulting engineering firm. Degrees and 1 to 5 years' design experience desired. Wide variety of interesting work in the design of water supply and distribution, water treatment, sewers, pumping station and sewage treatment facilities. Pleasant living conditions close to work in college community. Apply by letter, giving references, experience, and starting salary expected. Location: Oregon. W-5538.



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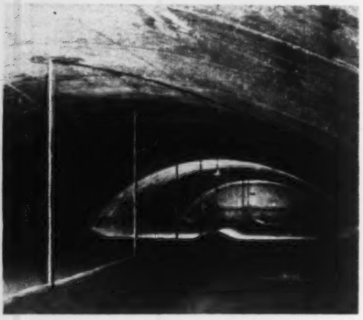
EQUIPMENT, MATERIALS and METHODS

NEW DEVELOPMENTS OF INTEREST AS REPORTED BY MANUFACTURERS

Stainless Holds Up Huge Tunnel Duct

THE BIG NEW TWIN-TUBE expressway being laid beneath Baltimore Harbor has an unseen but important feature—the use of stainless steel bars to suspend the base or floor of the huge ventilation duct. Fresh air enters the giant tubes below the roadways. Dangerous gases are eliminated by exhaust ducts that serve as the tunnel ceilings. The type 302 stainless steel bars, comparatively thin to cut down resistance to air flow, possess the strength needed to hold up the tremendously heavy ceilings or duct floors. They also will resist corrosion from moisture and exhaust gases, an important consideration where replacements would be difficult and costly. **Armco Steel Corporation, CE-11, Middletown, Ohio.**



Big Muscle Backhoe

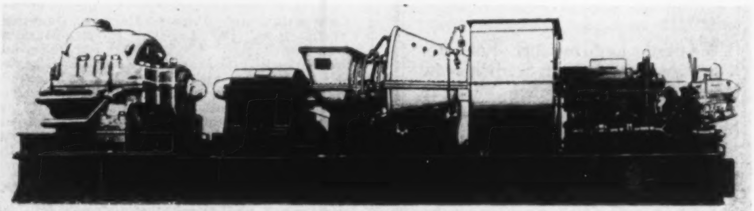
DIGGING FROZEN EARTH at any time, or in any place is difficult, but the Big Muscle Backhoe has what it takes to do the job successfully. Starting a trench is always the toughest part of digging, but in frozen ground the difficulty is multiplied many times. If too much down pressure is exerted by the lift cylinder, it takes the weight away from the outriggers and allows the machine to slide backward. This is where the heavy structure of the backhoe really pays off. The bucket teeth have sufficient penetration without exerting enough down pressure to lighten the outriggers. When digging in frozen ground, oil must be bled off some cylinders and into others at exactly the right moment, depending upon the position of the bucket and the degree of completion of the hole. The patented dual "One-Trols" (two levers which control the dig, hoist, swing and bucket actions) make the machine easy to handle, even by an unskilled operator. After the ditch is started it requires a lot of power to break the crust as the digging progresses. The patented "Big Muscle" feature, which combines a powerful hydraulic system with mechanical linkage, gives it plenty of power to do the job. Another exclusive feature is the ejector bucket, which eliminates lost time during wet winter weather. This device automatically ejects all wet, sticky material from the bucket during the dumping cycle. No extra control is necessary. The backhoes are available for most popular makes and models of industrial wheel and crawler tractors. **Ottawa Steel Division, L. A. Young Spring and Wire Corporation, CE-11, Ottawa, Kansas.**

Horizontal Shoring

SPANALL, THE NEW ALL-METAL horizontal shoring for concrete floor forms, safely eliminates the need for vertical shoring, thus leaving open all floor areas below for the storage of materials. The sections are easily and quickly assembled and the camber is automatically and correctly set simply by adjusting a single screw at the ends of each lattice section. After stripping, all sections may be telescoped for storage when not in use. **Spanall of the Americas, Inc., CE-11, 787 United Nations Plaza, New York 17, New York.**

Portable Electric Hoist

FOR CONSTRUCTION WORK, INDUSTRY and in fact, any place where objects have to be lifted, the new Haynes High Hoist will do the job fast and economically. It is the most inexpensive power lift made, for it can move material to any height for pennies per ton. Being completely portable, it is easily moved and set up by one man in a matter of minutes. Here is how it works. The top boom fastens to the top of the scaffold, or use the "A" frame boom and place on top of the building or floor to be served. A 2000-lb test endless cable is inserted through the clutch arm and over the top boom pulley and the ones of the power unit below. The U.L. outdoor approved G.E. electric motor is switched on and the Quick-Connect hook is placed on the cable with its load attached. It is then effortlessly lifted to the top. If no one is available to remove the material when it arrives, the upward movement is stopped by means of an automatic clutch; the operation is continued when the material is removed from the cable. The hoist is especially recommended for factories, stores, buildings, construction work, bricklayers and cement and concrete workers. **Haynes Inc., CE-11, 4982 Park Lane Road, East Lansing, Michigan.**



Single Shaft 3250-HP Gas Turbine

A NEW GAS TURBINE USED as a mechanical drive for pumps, compressors or generators has been added to the family of available gas turbines rated at 5000, 8000, and 12,000-hp. It operates at 8500-rpm and any output speed can be obtained through the use of gearing. A quick starting feature permits the power plant to reach operating speed in less than three minutes. At full load, the exhaust flow is approximately 191,000-lb per hour at 775 deg F. This relatively high exhaust temperature can be used to produce low-pressure steam with a waste heat boiler or a heat exchanger located in the exhaust duct. The machine is 21-ft long, 6-ft wide and 4½-ft high and weighs only 14,000-lb. The small size and weight permits installation in a limited area at a minimum of cost in foundation and building. Mounted on a common bedplate, the unitized structure consists of gas turbine, driven apparatus, starting equipment auxiliaries and controls. This type construction keeps installation costs to a minimum because all integral piping and controls are included in one assembly. Only the external utility connections are required before the plant is ready for operation. A minimum of operating personnel is required due to fully automatic protection and semi-automatic starting and stopping controls. The system is so arranged that it can be adapted to remote control. **Westinghouse Electric Corporation, CE-11, P. O. Box 2099, Pittsburgh, Pennsylvania.**

Paymover Towing Tractors

THE FIRST TWO PAYMOVER TOWING tractors for commercial applications have just been announced. They are the model T-50 with 5,000-lb drawbar pull and the T-60 with 6,000-lb. These two-wheel drive machines feature torque-converter drive, automatic transmissions, and are ideally suited to industrial tractor-trailer, rail and motor truck terminal, and stevedoring operations as well as the handling of all types of corporate aircraft for airport terminal movement. Head and tail lights are standard equipment on these units and a wide variety of coupler attachments are available. **The Frank G. Hough Company, CE-11, 938 Seventh Avenue, Libertyville, Illinois.**

PAYMOVER
PAYMOVER

Compact and Maneuverable

Research Center to Use Steam Exclusively

STEAM ASSUMED AN important role in the development of the nation's guided missile defense program today when The Babcock and Wilcox Company announced it will furnish the boiler and related generating equipment at the Research and Development Center now being built. Located on a 1050 acre site approximately 20-mi south of Roanoke, Va., the Center will use the steam exclusively for conduction research projects, including the testing of components for missile system experiments with monopropellant and bipropellant fuels. To simulate conditions at actual operational altitudes of the missile, steam will be used to operate the ejectors which exhaust both the turbine discharge and the experimental test chamber. It will also be used as a heat source for preliminary heating to temperatures of 399 deg. F. Having a design pressure of 300-lb per sq in., gage, the boiler will deliver saturated steam at 275-lb per sq in., gage. Its normal capacity will be 40,000-lb per hr. Because of the unusually heavy contamination of the process steam due to entrained products of decomposition and combustion, condensate will not be returned to the boiler. Thus 100% of the ejector steam when condensed will be discharged to the sewer. Utilizing an outdoor design of the unit for a semi-outdoor installation, about one foot of the front of the boiler will project into the enclosed boiler room to allow indoor control. This arrangement was advanced by McConathy, Hoffman and Associates, Inc., of New York, consultants on the project. **Babcock and Wilcox, CE-11, 161 E. 42nd Street, New York, New York.**

Portable Tracing Unit

A LIGHTWEIGHT, ILLUMINATED portable tracing unit, the Porta-Trace, is now being offered. This drafting unit can be used by design engineers, technicians and draftsmen in preference to old fashioned, costly stationary tracing tables. Its flexibility permits use in a wide variety of operations. For photographic work, it can be used for opaquing, retouching, stripping-in and viewing transparencies. For reproduction, it will speed the preparation of Bristol board originals, multilith paper originals, mimeographed stencils, color separations, and visual-aid transparencies. In the drafting room, the unit is thin enough to be slipped under a string type parallel rule on a standard size drafting board and its compact dimensions permit convenient use under a standard straight edge or drafting machine. Rubber feet hold it in position, even at an acute angle. It can be easily shifted enabling the draftsmen to make drawings at various angles. Not only will it facilitate tracing of sketches and faint blueprints, but will also show up light gray lines and other inking defects. The Porta-Trace has a shatter-proof opal plexiglas top which gives maximum light diffusion with a minimum of glare, and the flush top permits use with drawings that are larger than the unit. The warm surface dries the ink rapidly and its fluorescent lighting prevents over-heating. It is available with tracing surfaces ranging from 10 x 17¼-in. to 23¼ x 36¼-in. All component parts are UL approved. **Ozalid Division of General Aniline and Film Corporation, CE-11, 6 Corliss Lane, Johnson City, New York.**

Mobile Construction Building

A STANDARD-DESIGN construction building on wheels answers the demands of contractors and builders for all-out mobility from job to job. Ideal for field office, storage or temporary housing, tool shed or workshop, it is a rigid, factory-constructed, 7½ x 16 ft building. It is union-built of the finest kiln-dried, tongued-and-grooved west coast lumber and mounted on a heavy-duty steel under-carriage. Trailer is equipped with tires and electric brakes controlled by the driver. The building is demountable from carriage or is available without under-carriage, complete with floor. **Economy Buildings, Inc., CE-11, West Chicago, Illinois.**

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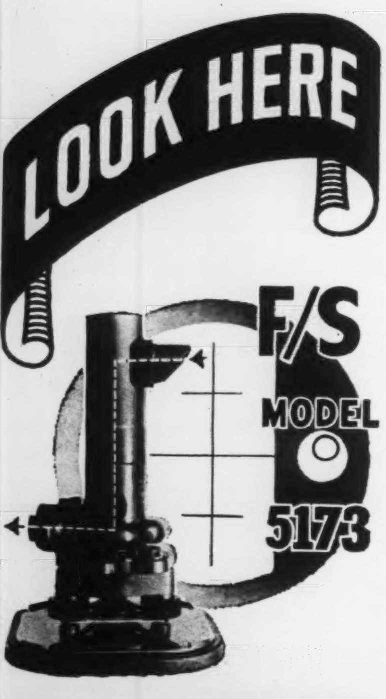

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- Pendulum unit for self-leveling.
- Viewing of bull's eye level through telescope eyepiece.

ERECT IMAGE

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- Sliding-leg Tripod with shifting head.

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EQUIPMENT, MATERIALS and METHODS

(continued)

Tripods

A NEW LINE OF BRONZE HEAD wide frame tripods, 3½-in. in dia and 8 threads to the inch, has been announced. A solid bronze tripod head with bronze bearings is mounted on legs of selected solid maple. Shoes are 7-in. long and have oversize push-down spurs which are heavily trussed for additional strength. **C. L. Berger and Sons, Inc., CE-11, 37 Williams St., Boston 19, Mass.**

Deluxe Model Air Trac

THE NEW MODEL DELUXE Air Trac has been designed to provide complete power positioning of all vertical, horizontal and flat lifter holes. A new hydraulic drill positioner, Model DPAT, is said to give 120-deg mast swing and can be indexed for an additional 90-deg swing. It permits 90-deg dump and can be indexed for a full 360-deg dump. Twin hydraulic cylinders allow a T-bar lift of 86-deg 30 ft, which will bring it from below horizontal to nearly vertical. All controls on the machine, for mast positioning, crawler drive and drilling, have been centralized on a single remote-control panel, permitting finger-tip control of all operations. Other improvements include: new jaw clutches on the drive shafts which give it free wheeling for towing from job to job; a theftproof tool box; and a driver's seat for operator comfort and safety. A convenient accessory is the portable air-driven bit grinder, which eliminates waiting or sending back for bits, and allows spare bits to be sharpened while drilling progresses. **Gardner-Denver Company, CE-11, Quincy, Illinois.**

Screw Elevator Handles Cement

A SINGLE SCREW ELEVATOR played a major role in the construction of Texas' first turnpike, new 30-mi, $58,500,000 superhighway between Dallas and Fort Worth. It is believed to be the first such use of a screw elevator and demonstrated several advantages over installations normally used to meet cement-handling needs of paving and building contractors and producers of ready-mix concrete, dry-mix concrete and concrete products. The 12-in. dia screw handled most of the cement for the 448,300-cu yds of concrete used in pavement and bridges of the new turnpike. Discharging 150-tons of cement per hour, the elevator loaded a truck with 40-bbl capacity every 3-min. The screw elevator, which has an 18-ft lift, was fed by a 12-in. "Fort Worth Beeline" screw conveyor extending beneath the rail spur. Here efficiency of the screw elevator eliminated the need for the bucket elevator, which was previously used to move the cement from hopper cars to trucks—discharging at a rate of only 50-tons per hour. In addition to having only one-third the height, one-third the cost, and three times the capacity of the bucket elevator, the screw elevator also has the advantages of compactness and portability. In three hours, three men can dismantle the screw elevator and have it enroute to a new location. A permanent foundation is not needed. The screw elevator and feeder conveyor may be driven from any convenient power source. **Fort Worth Steel and Machinery Company, CE-11, Fort Worth, Texas.**

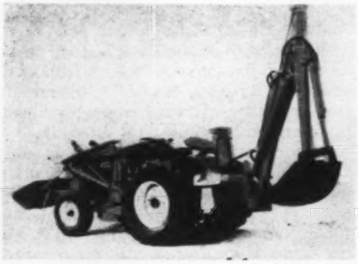
Available in 2 models

Vertical-Pak Roller

A NEW DESIGN IN ROLLERS is offered by the Vertical-Pak Roller, which affords vertical oscillation in its weight class for the first time, through action of the rear wheels. It gives a constant, uniform wheel load and capacity on uneven surfaces, over soft spots, and where stones or boulders are present in the materials undergoing compaction. Tests reveal this action reduces tire hazard as much as five times. Excessive weight on any one tire or wheel is impossible under normal operating conditions. Curbs and other obstacles are no longer a hazard in close work. It places the operator in a position to see both forward and reverse equally well at speeds in both directions up to 15 mph. Extra strong rear wheels are especially manufactured for this particular machine. Ballast capacity is 120-cu ft. Differential individual chain drives to all 4 drive wheels. Overall length of the machine is 13 ft 1 in., overall height is 78-in., and overall width is 84-in. The roller is available in both 11 ton, 11 wheel models, and 9 ton, 9 wheel models. 50 hp gasoline or diesel power is optional. Tires are 7:50x15, four ply. Six ply tires are optional. Shipping weight is approximately 7500-lb. **Southwest Welding and Manufacturing Company, CE-11, Alhambra, California.**

New Backhoe

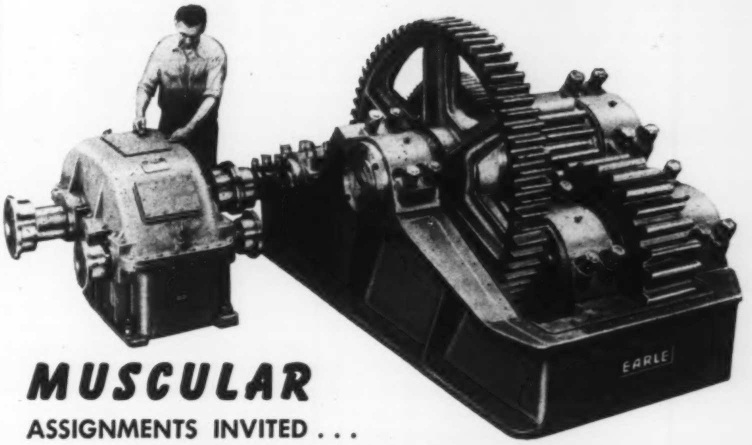
THE NEW MODEL WR-350 backhoe, for mounting on International Harvester 300-350 utility tractors, has just been announced. Increased speed and power, plus greater loading height, enable it to handle a wider variety of difficult trenching jobs, bell holes and foundation excavations, utility trenches, and service lines. A digging range of 190-deg, a digging depth of 12-ft below grade, and loading height of 9-ft combine to make this machine a flexible, versatile attachment engineered to operate profitably under the most cramped conditions. A new and unique link-lever swing system provides extra smooth cushioned swing. Smooth operation is increased as all normal swing linkage wear is automatically compensated and adjusted. The boom and dipper stick are welded box sections of high strength steel designed for best load distribution and minimum weight. Powerful crowd cylinder provides maximum digging power, plus high-speed retraction. Twin boom cylinders provide tremendous down pressure, lifting capacity and break-out force. Simple, positive and trouble-free operation result from finger-tip control of the hydraulic system. **Wain-Roy Corporation, CE-11, Hubbardston, Massachusetts.**



Increased Speed and Power

Tarpaulin

A NEW METHOD ALLOWING the worker on the job to install any size tarpaulin from a large continuous roll was just developed. Eliminating almost 75% of the usual fabrication cost for hemming and grommeting tarpaulins, this method guarantees a stronger tie-down to resist wind forces. It calls for penknife slits to be placed along the edge of the fabric and positioned wherever a tie-down is desired in the field. This new technique is made possible through an exclusive process that permanently locks vinyl plastic to nylon fibers resulting in a tarp fabric with such tremendous resistance to tearing that slits cut in the manner described will not spread, and edges will not travel. A variety of tough industrial nylon tarp fabrics are available in roll widths up to 20-ft and can be provided up to 100-ft wide. **Herculite Protective Fabrics, CE-11, Belleville 9, New Jersey.**



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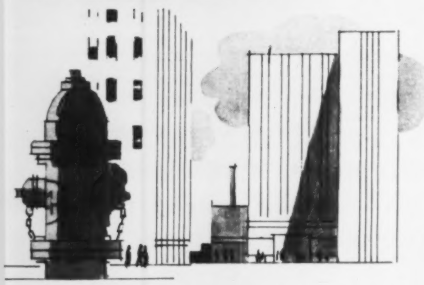
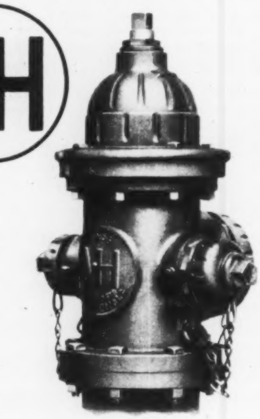
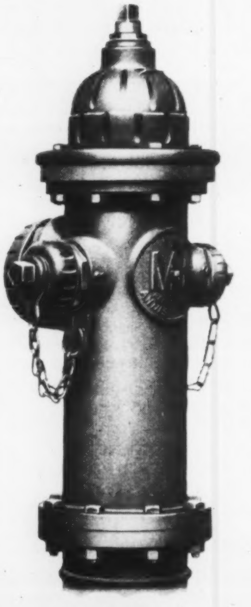
Steel Highway and Bridge Guard Rail

A NEW DEEP BEAM HIGHWAY and bridge guard rail, made of tough carbon steel, is designed to be a high-strength, visual barrier to protect bridge approaches and to safeguard highway traffic, particularly on curves and deep fills. The Granco rail will deflect cars parallel to the roadway since beam strength and height prevent cars from hurdling over or going under the guard rail. Unique flared end sections help prevent cars from hitting the end of the rail head on. The rail is of two types. Highway Guard Rail is made of 12-guage steel and bridge rail is of 10-guage steel. The rail is corrugated with two convex curves and one concave curve. The corrugations are 3¼-in. deep. It is designed to fit on posts 12-ft, 6-in. apart. When the rail is to be installed on curves with a radius of less than 150-ft, the rail is curved in the shop before erection. **Granco Steel Products Co., CE-11, 6506 N. Broadway, St. Louis 15, Missouri.**





Standard model



Traffic model

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Along the streets of hundreds of U. S. villages, towns and cities stand modern sentinels of fire protection: M & H fire hydrants. Where you see them, too, you can be reasonably sure they are the mark of lower fire insurance rates. Assuming an adequate water supply, an efficient distribution system and a fire department, M & H hydrants are the last of the four principal factors which mean good fire protection and lower insurance rates.

An M & H hydrant may long stand idle, yet functions perfectly when needed. Large inside diameter and unobstructed waterway gives high flow efficiency. Operating parts are bronze or bronze bushed. Furnished either UA & FM approved or A.W.W.A. specification, standard model, traffic model or flush type. For complete information, address

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Viewer for Long Prints

A CONVENIENT, NEW, space-saving long-print holder, for viewing blueprints, drawings, photos, maps, up to 40-ft or more in length in an area of approximately 40-in. x 48-in. on wall, table, desk or station wagon tailgate, is now available for manufacturers, engineers, builders, surveyors, ship builders and aircraft workers. Called the Roll-O-Print Long Print Viewer, it is available in two different models. Model "A" can be secured to wall with screws and two brackets, or mounted on any flat surface with two clamps. A plywood or masonite backing board also can be attached to the center frame for marking on prints. Model "B" clamps on horizontal surfaces of any length such as on desks, tables, or benches. Long prints are rolled flat on the two vertical rolls and are effortlessly moved into view by turning either of two convenient fingertip controls, located at the base. It soon pays for itself through savings in man hours by having prints, drawings, maps and long photos located at the center of work activity. It is especially useful too, where blueprint storage and working space is at a premium. Extra interchangeable rolls for easy storing and preservation of long prints are inexpensive. Standard Roll-O-Prints accommodate prints 36-in. wide by 40-ft or more in length, but can be supplied for wider prints upon request. **Aqua Sportsman, Inc., Dept. 78, CE-11, 2518 Leslie Avenue, Cincinnati 12, Ohio.**

Sky-Hy Loader

A NEW EXTRA HIGH LIFT loader has been developed for use in various industries where a mobile unit with great lifting heights and high capacity is needed. Attachments have been designed for use in most of the applicable industries and range from telescopic towers and concrete buckets for building contractors, crane attachments for setting steel and other straight lifting jobs, to adjustable width lifting forks, with or without hydraulic hold-down finger for the logging, lumber and allied industries. The extendible reach feature, which gives up to 40-in. of horizontal movement of the load, allows for maximum reach when lifting over scaffolds and other obstructions, plus a close-to-wheels carrying position for added stability. It also means that when picking up or placing a load, the operator can position the machine in the approximate location and then reach forward to pick up the load, rather than moving the machine to the load. **Lull Engineering Company, CE-11, 3045 Highway 13, St. Paul 11, Minnesota.**

Viking Roller Blade

THE TRACTOR-MOUNTED VIKING offers a unique land leveling feature. By virtue of its floating nature, it shears off high spots and fills in low areas automatically without operator adjustment. A grid-type roller follows the blade, stabilizing it and at the same time breaking up the hardest clods—leaving a perfect soil bed. The seeding-fertilizing attachment features a newly designed agitating system, making a most accurate dispenser for precision broadcast seeding and fertilizing. Hand levers conveniently near the tractor seat control the flow. The 6-foot wide heavy duty blade, available with scarifier or rake loosens and levels the soil. The steel grid rolls along behind the blade and pulverizes the clods. **Viking Manufacturing Co., CE-11, Manhattan, Kansas.**

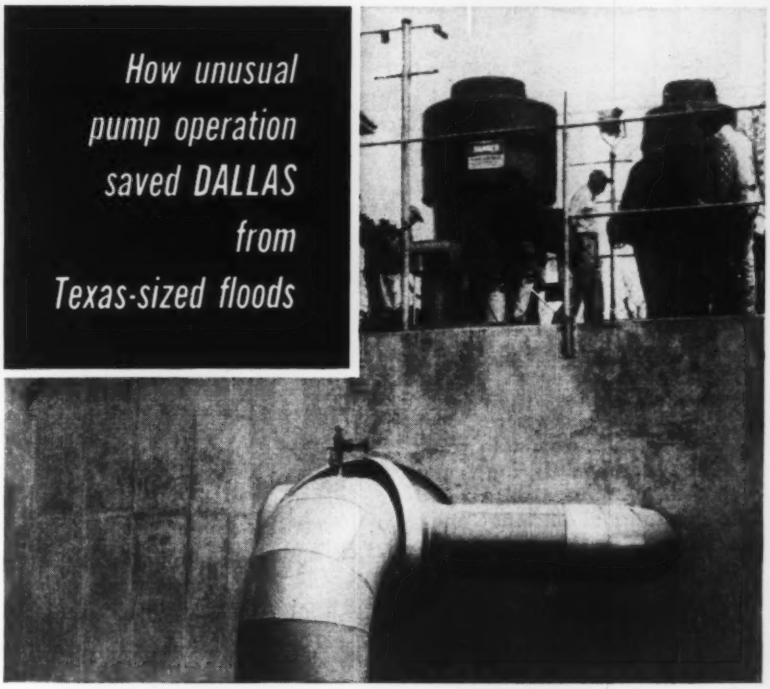
Unique land leveling feature

Tube Dust Washer

A NEW TRIPLE WET TUBE dust washer has been developed for the purpose of dust abatement and air washing of asphalt plant dryer exhaust. The internal construction is able to withstand the corrosive effect of the dilute acids resulting from fuel combustion. To assure low-cost maintenance, the washer is readily serviced through large manholes in the ends with sprinkler manifolds easily removed in one assembly. Water control to each unit tube is arranged from a central valve unit. The dust-laden hot air and gasses from the dust collector exhauster enter the whistle connection on the first tube and spiraling rapidly under the action of the water sprays, continuing their passage through each of the tubes in series, and finally passing from the third tube into a large diameter stack equipped with one final washing spray. Sludge removal is provided at the base of the stack through a 6-in. diameter outlet so that the sludge may be piped off to a drain tile and settling pit. **Madsen Works, Baldwin-Lima-Hamilton Corp., Construction Equipment Div., CE-11, 14120 East Rosecrans Ave., P. O. Box 38, La Mirada, California.**

Sump Pumps

A LINE OF COMPLETELY redesigned non-clog sump pumps is now available for drainage, sewage disposal, underpass service, and industrial service. The new pumps are made in 3-in. and 4-in. sizes with capacity range from 20 to 1100 gpm. Heads go as high as 160-ft. Principal gain from the new design is less maintenance and easier servicing. The latter is achieved by a split motor stand, allowing access to motor, pump shaft and bearings. After removing only four bolts, motor can be lifted off the pump without disturbing piping. Self-lubricated bearings are used to eliminate lubrication problems. Both the double sealed ball thrust bearings above the floor plate and the intermediate sleeve bearings used on the shaft when the sump depth exceeds 4½-ft will operate for the lifetime of the pump without outside lubrication. The sleeve bearing is in a registered housing to assure perfect alignment. The pumps are equipped with grease packed stuffing boxes, which eliminate the need for repacking and consequent down-time. For greater strength, the shaft is constructed of alloy-steel and is oversize from floor plate through the impeller. The shaft is machined and polished to close tolerances. Rotating parts are statically and dynamically balanced. **Economy Pump Div., C. H. Wheeler Manufacturing Company, CE-11, 19th and Lehigh Avenue, Philadelphia, Pennsylvania.**



Wheeler-Economy 20" x 24", 10,000 gpm and 24" x 36", 20,000 gpm Vertical Mixed Flow Pumps, which helped prevent Dallas from flooding during heavy rains last spring. Pumps moved 43 million gallons of flood water daily, even though they were installed as cooling pond makeup pumps.

By ingenious use of Wheeler-Economy Sewage Pumps, Makeup Pumps and Flood Control Pumps, Dallas recently saved itself from the worst floods in its history.

Rains which fell last April and May had covered much of Texas and posed a serious threat to Dallas. The six Wheeler-Economy Vertical Mixed Flow Pumps at the Corps of Engineers Hampton Roads and Pravaho Stations were moving 260,000 gallons of flood water a minute—but even this capacity proved inadequate. So Dallas authorities quickly put into service the four Wheeler-Economy Sewage Pumps at its White Rock Station and the two Cooling Pond Pumps at the Dallas Power & Light Northwest Station (shown above). Working together, all of the units pumped 383,000 gpm and eliminated the threat of flooding.

Two new catalogs describing Wheeler-Economy Axial and Mixed Flow, and Mixed Flow Volute Pumps are now available. May we send you one or both?

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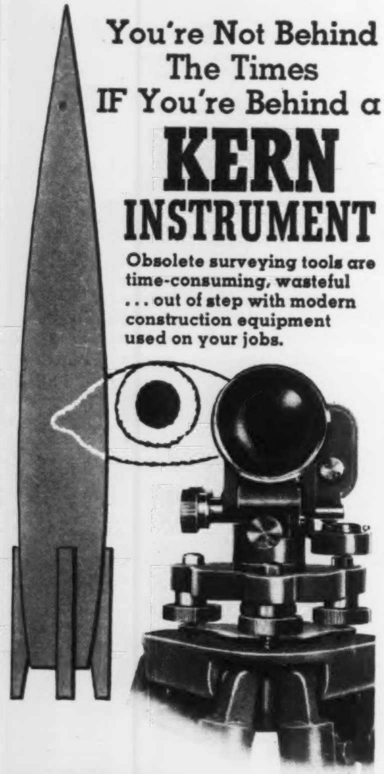

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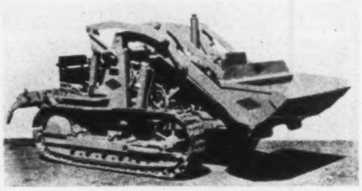
EQUIPMENT MATERIALS and METHODS

(continued)

New Loader

Designed specifically for the John Deere 420C crawler tractor, a new version of the hydraulically-operated L-420C loader is now in production. Features of the new loader include increased ground-level tilt-back for exceptionally high break-out power, increased bucket capacity (to ⅞ cu yd), reinforced lift arms to handle the larger bucket, replaceable bushings at all hinge points for longer service life with less maintenance, increased track clearance and improved mounting method to increase stability, eliminate excessive tractor strain and track wear. Maximum lift is 9-ft 7-in. for ample truck loading clearance. Bucket is 60-in. wide, dumps at 50-deg angle; maximum tilt-back at ground level is 32-deg. Scarifier-counterweight, lift fork, hay fork and crane attachment are available. **American Tractor Equipment Corporation, CE-11, 9131 San Leandro Blvd., Oakland 3, California.**



Hydraulically operated

Aluminum Welding Machine

An improved automatic machine for welding aluminum described as "the first proved by field tests to be fully operational for pipeline construction anywhere" has been unveiled. During the operational test the new machine made the dramatic record of welding 2,880-ft of the pipe in a 4-hr period, with no supplemental hand welding needed at any point. This means an average of 18 satisfactory welds every hour. Other advantages of the new machine are: it has more automatic features, requiring less attention from the welders, it is more ruggedly constructed, and its overall operating time, joint to joint, is less. In basic form, it is very similar to the 1954 device. The unit rotates around the pipe, carrying a shielded electric arc. At the same time inert gas is released to blanket the area being welded. The 1954 model made four-pass welds around the pipe in an average time of 2-min. Joint-to-joint time in welding pipe sections was a little more than 4-min. The machine is suspended from a side-boom truck or tractor. **Reynolds Metals Company, CE-11, Third and Grace Streets, Richmond 18, Virginia.**

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NEW! *The Practical Guide to—*

Basic Soils Engineering

B. K. HOUGH. This is the first book to reflect many of the developments in soils engineering procedures and equipment made during and immediately after World War II. Offering expert guidance, book interrelates the fields of structural foundations, earthworks, highway and airfield engineering. Discusses the development of osmotic pressure in clays and its effect on soil structure and compressibility; explains a new theory for the migration of water into zones of freezing. Clarifies the distinction between solid and viscous friction effects in soils generally, and of rupture theory for clays. *227 ills., tables; 513 pp.* $8

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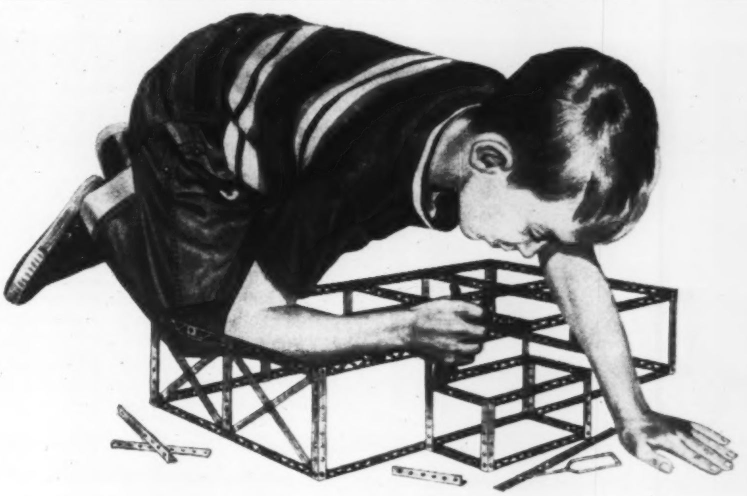
Model 210 Tractor Scraper

STRIPPING OVERBURDEN IN THE Huron Quarry in Flat Rock, Michigan, contractor Charlie Cassey clocked a Michigan Model 210 tractor scraper and saw it move 200-cu yd in a 60-min period. Push-loaded by a crawler tractor, the machine scooped up a 14-yd payload in less than a minute. It unloaded on-the-run in 10- or 11-sec then sped back to the cut at speeds up to 30-mph. The 260-hp rig climbed grades from 8 to 19%, but did not lose any time in the transitions. The operator did not have to come to a stop at the grade difference to shift gears; power-shift transmission and 3-to-1 torque multiplication took care of the change in load conditions. The Michigan, working a 13,000-ft (one-way) haul distance, ticked off an average cycle time of 3.6-min. Each payload —blue clay, soapstone, plus a rock and clay mixture—weighed roughly 43,200-lb. **Clark Equipment Company, CE-11, Benton Harbor, Michigan.**

Moves 200-cu yd an hour

Aluminum Sand Castings

FOUR ALUMINUM SAND CASTINGS, constituting the largest cast aluminum assembly ever produced, were installed in the heavy machining department of North American Aviation, Inc. Weighing more than 12½-tons, the sections were fabricated in sand foundries to become part of a wing fabricating table which will hold a wing panel for precision milling. When assembled, all four parts of the chuck measure 28-ft in length, 130-in. at the widest point, and 16-in. deep. Heaviest of the sections weighs 7,500-lbs. Until recently, equipment of this type was fabricated from ferrous alloys. North American, however, specified aluminum because the chuck, as originally designed for ferrous metal, would have been too heavy for the foundation prepared for it. The light metal's ease of machining was another important reason for the change. Machining aluminum parts costs about half as much as the same operation for steel parts. The air blast quenching technique, which removes residual stresses, assures a dimensionally stable casting. Machining tolerances at the chuck surface are maintained to within plus or minus two one-thousandths of an inch in order to insure that the finished part is held to within plus or minus .005-in. Six thermocouples, attached to a recording device, were placed at strategic points in each of the molds while hot metal was poured. By referring to readings from these instruments, the rate of cooling was studied to determine soundness of the part. Each casting was "fed" molten aluminum for more than 30-min to compensate for contraction of the cooling metal at the center of the section. The relative light weight of the assembled chuck meant greater handling ease, requiring but one-third the time for installation. As an aluminum casting, the part has more rigidity and will withstand more torsion in use than a conventional welded assembly. **Aluminum Company of America, CE-11, 1501 Alcoa Bldg., Pittsburgh 19, Pennsylvania.**



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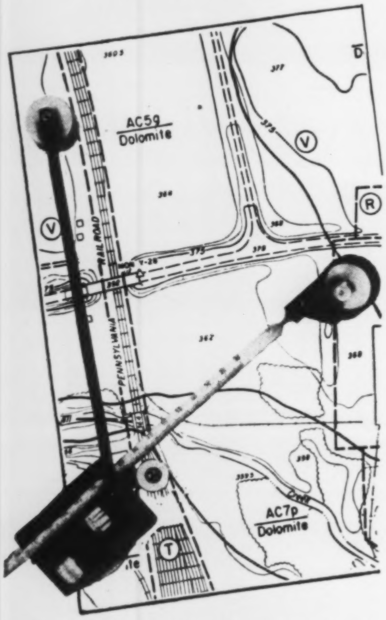

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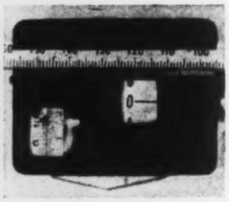

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EQUIPMENT, MATERIALS and METHODS

(continued)

Ball Bearings with Seals of Teflon

LUBRICATED-FOR-LIFE ball bearings utilizing new-type seals of Teflon are a recent development. The seals are designed to provide positive line contact between the inner raceway of the bearing and the permanently attached full metal shields. Sealing action is so effective that the lube, applied at the time of bearing assembly, can be expected to last as long as the bearing itself. The seals of Teflon not only prevent lube leakage, but act as a slinger to improve circulation, and prevent dirt and foreign particles from reaching the working surfaces inside the bearing. Teflon was selected because of its chemical inertness, exceptional toughness, long wearing qualities, and its ability to withstand temperatures far beyond those experienced in normal bearing operations. Its low coefficient of friction eliminates torque resistance problems. Ball bearings with seals of Teflon are recommended for applications requiring sustained high speed operation, or where periodic lubrication or servicing is not practical, as in sealed units. They are available in light and medium series. **Hoover Ball and Bearing Company, CE-11, Ann Arbor, Michigan.**

Hydraulic Truck Crane

A NEW, FULLY HYDRAULIC, ONE man operated truck crane has been announced for distribution to the federal, state, county and city agencies and public utilities markets. Manufactured originally in Sweden, and known as the Hiab 170, it requires only 15-in. of space between the cab and truck bed, leaving the entire truck bed open for load. It offers a range of lifting capacities from 6000-lb on the shortened boom of 5-ft, to 2500-lb on the full boom of 13-ft. The length is easily adjustable through hydraulic control. The crane will lift up to 20-ft above ground level at a maximum speed of 20 inches per second. Control is from either side of the truck cab. Action is positive and accurate, and swings in a 360-deg arc. When not in use the Hiab 170 folds snugly behind the cab in the 15-in. space allotted to it. Hydraulic outriggers to handle heavy loads are standard equipment.

With complete parts and service available throughout the United States, this machine has proved ideal for machinery, large tire, and pipe handling, and loading and unloading of crates and boxes containing any materials. **Stanco Manufacturers and Sales, Inc., CE-11, 1931 Pontius Ave., Los Angeles, California.**

Indicator-Totalizer Type 245

THE NEW INDICATOR-TOTALIZER Type 245, designed exclusively for water works use, has just been announced. The result of 8 years of research and development, it provides flow rate and totalization in any standard measurement and is furnished with a versatility which permits it to be directly mounted on all standard Sparling Meters. Housed in a handsomely styled compact unit measuring only 4¾-in. high, the rugged mechanism has the precision of a watch. Heavy duty, corrosion resistant materials provide for long life on main-lines. Flow rate is indicated similar to that of a "speedometer" on an easily read 3 in. dial face, black satin finished with white letters. **Sparling Meter Company, CE-11, 225 North Temple City Blvd., El Monte, California.**

Designed for waterworks use

Mobile Work Shop

CALLED A MOBILE WORK SHOP, a new truck-mounted shop on wheels is particularly useful in bridge and other construction work as well as in general maintenance. A noteworthy feature is the winch equipped 5-ton crane which can be completely disassembled and stored inside the truck when the vehicle is in transit. It also has a 125-cu ft air compressor, a 15-kv generator and a 40-v welder, all operated by a split-shaft power take-off. Compartments and sidewall bins provide storage. **Cemco Industries, Inc., CE-11, Galion, Ohio.**

Dynamometer

Actual stress readings in psi on each wire have replaced strain measurement by elongation in inches on pretensioning the wires at Schell Industries, Ltd., prestressing plant at Ontario, Canada. The illustration shows a Dillion dynamometer measuring the tension in a seven-wire ⅜-in. dia strand having an ultimate strength of 250,000 psi used on a 400-ft long prestressing bench. When a 14,000-lb load is attained the free end of the strand is anchored.

Dynamometers, which can be used for innumerable applications where weight or tension is to be measured, are available in standard models covering various ranges between 0-500 lbs to 0-100,000 lbs from W. C. Dillon & Co. of Van Nuys, Calif. As a standard checking feature, an extra hand on the dial face is pushed forward by the main hand. After the load is released, the main hand returns to zero while the extra hand remains at the peak measurement of the load. The dynamometer may be loaded while suspended vertically, lying-flat or resting on one side without affecting accuracy. Entirely mechanical, the dynamometer has no cylinders to leak; loads applied produce a smooth positive action with no drift. **W. C. Dillon and Co., CE-11, Van Nuys, California.**

Trojan Tractor Shovels

Widely used in road building, construction, in the handling of bulk chemicals, agricultural products, sand and other materials, the Trojan tractor shovel is designed to insure its users of peak production with complete safety. The patented reverse curve arms guarantee the operator full 360-deg vision with complete personal safety, since they are below the level of the operator at all times—even when the bucket is raised to its full height of 10-ft, 3-in., at the hinge pin. Straight-line horizontal thrust permits constant crowding of the work pile while maintaining full traction on all four wheels and normal steerage. This enables the engine to use full power at all times without the danger of jack-knifing and reduced traction. These advantages are possible because Trojan design puts the push-point low and at the rear of the machine so that the thrust is directed in a straight line. **The Yale and Towne Manufacturing Company, CE-11, Chrysler Building, New York 17, New York.**

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With accurate sub-soil information, *you avoid* costly trouble later on. And, what better way to get this information than with a portable, easy to use Acker Soil Sampling Kit. For here is a versatile collection of twelve soil sampling tools packed in a handy steel kit that can be carried in any car.

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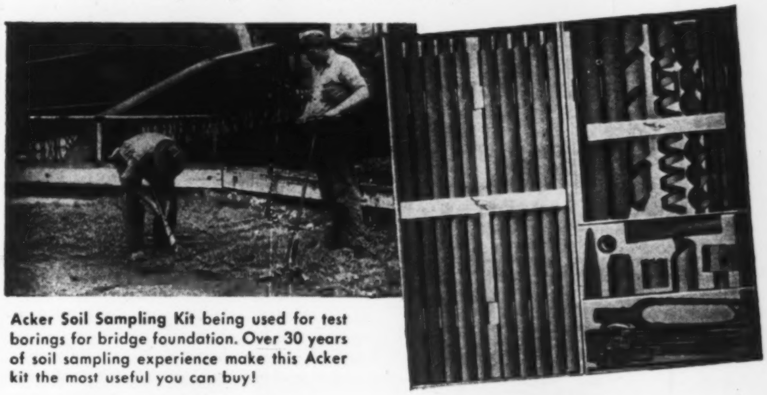

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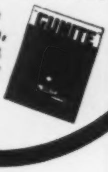

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EQUIPMENT, MATERIALS and METHODS

(continued)

Rubber Tired Ripper-Dozer

Faced with the job of rebuilding a number of boulevards throughout the city, the Los Angeles Department of Public Works needed a heavy duty tractor with bulldozer and a big ripper to tear up old surfacing. As no manufacturer offered all these features in a single unit, the Department contacted the Crook Co., L. A. distributor for LeTourneau-Westinghouse Co. products which agreed to manufacture the ripper and install it on a Tournatractor. According to supervisors at the City Equipment Yards, it has so much power that, "the ripper slices through a macadam street like a hot knife through butter!" **LeTourneau-Westinghouse Company, CE-11, Peoria, Illinois.**

Combination does the job

Fresh Concrete Tester

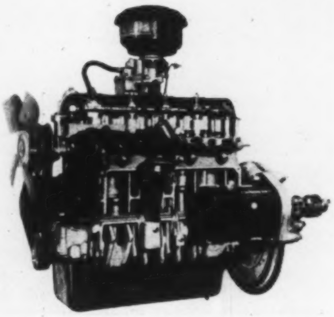
The ball penetration apparatus, a new instrument for determining the consistency of fresh concrete is now available. It is made in accordance with ASTM specification C-360, Ball Penetration in Fresh Portland Cement Concrete. It consists of a cylinder with ball shaped bottom and a handle weighing 30 pounds. A lightweight metal frame guides the handle and serves as a reference for measuring the depth of penetration of the ball. Fresh concrete may be tested either as placed in forms or in a suitable container. No experience is necessary to operate the instrument. The Ball Penetration test is considered to be much faster and simpler than the conventional slump test and is comparable in accuracy. Twice the ball reading is approximately equal to the slump of concrete. **Soiltest, Inc., CE-11, 4711 W. North Avenue, Chicago, Illinois.**

Overload Detection System

Steps have been taken to solve the trucker's problem of overload fines with the development of an Overload Detection System. Fleet owners can now transport maximum permissible payloads without suffering penalty or delay for actual or alleged violation of load limits. Two units—a weighing device and an alarm device are set up to weigh trucks as they pass. Because it is electromechanical, the weighing unit does not require the deep roadway pit needed by ordinary scales, nor does its fool-proof design and operation demand skilled personnel. The vehicle to be weighed is halted with the wheels of one axle resting on a three-by-ten foot scale plate, which is flush with the pavement and resting on four weight-sensing electronic cells. One axle at a time is weighed on these cells which are then translated into electronic impulses. If one axle load is overweight, the alarm rings and the truck is moved to weigh the next axle. Scales are available in models for weighing each axle or an entire vehicle individually up to 300,000-lbs. **Taller and Cooper, CE-11, 75 Front Street, Brooklyn, New York.**

Compact Engine

A new compact, lightweight industrial engine is reputed to provide more power per lb than ordinary engines of comparable horsepower. Known as the Fageol 44, the engine produces up to 45-hp at 5500-rpm, with running engine weight as low as 160-lb. Power-to-weight ratio of 3.55-lb per hp is attained. The 44-cu in. displacement engine measures only 23⅝-in. long, 15$\frac{9}{16}$-in. wide and 23⅞-in. high. The cylinder head is integral with the block, eliminating head gasket difficulties and adding to its compactness.



FAGEOL 44

A 4-cycle, 4-cyl, water cooled power plant, with 9:1 compression ratio and overhead valves operated by a gear-driven overhead camshaft, the engine has other features ordinarily found only in larger engines: full pressure lubrication; built-in oil cooler; removable water jacket side plates; statically and dynamically balanced crankshaft and flywheel; forged steel connecting rods and camshaft; precision insert bearings; 2-piece valves with flame-hardened tips; exhaust valves Stellite-faced; positive-acting rotators on all valves and gear-driven gear-type oil pump.

The Fageol 44 is suitable for use in air-borne equipment and industrial applications, where compact size and light weight are important factors in power source selection, as well as farm and hoisting machinery, lift trucks, tow tractors, construction equipment, fire pumpers, portable generators and classified applications. **Fageol Products Div., Twin Coach Co., CE-11, 850 W. Main St., Kent, Ohio.**

Chlorinator

THE ADDITION OF A NEW chlorinator to their line of V-notch equipment has been announced. The new Series A-721 Chlorinator can meter and feed up to 8000-lbs. of chlorine per 24-hr, and is adaptable to any type of chlorinator control. The feed rate may be adjusted manually or controlled automatically on a flow proportional or selective rate basis. The unit is constructed of plastic materials for corrosion resistance. Vacuum operation of the A-721 assures safety for plant personnel and equipment. **Wallace and Tiernan, Inc., CE-11, 25 Main Street, Belleville 9, New Jersey.**

Portable Mixer

A NEW SELF-SUFFICIENT mobile concrete mixer combines the many advantages of on-the-job mixing with the convenience of pre-mix handling. With Drive-A-Mix the need for wheelbarrows, concrete buggies, etc. is eliminated, labor requirements are reduced and formulae can be varied on the spot and from batch to batch. The portable batcher has a self-contained power unit, and can supply more than one mixer per pouring job. Drive-A-Mix has a road speed of 18-mph and can make a complete 360-deg turn in a 15-ft circle, overcoming any obstacle at construction sites. A low center of gravity makes it tip-safe. The mixer is compact: 7-ft 8-in. high, 74-in. wide, 11-ft 6-in. long. Its gross weight is 3460-lb. **Good-All Electric Mfg. Co., CE-11, Good-All Bldg., 120 First St., Ogallala, Neb.**

Sand Spreader

A NEW QUICK-MOUNTING sand spreader converts an ordinary dump truck into a road spreader within 15-min. The spreader is firmly anchored to a truck box by tie rods with built-on hand cranks. Adjustable shafts lock on tailgate latches. Installation is accomplished by simply lifting the spreader from its storage dolly onto the truck body, lining up the shafts at the tailgate and running down the hand cranks. Road tests show that dead heading back to the sand pile is cut one-third because the spreader covers 50% more road than most other spreaders with the same amount of sand. The spreader also distributes salt, calcium chloride or chips. Spread is adjustable from 8 to 32-ft. By using an auger feed in place of the common apron chain or drag bar a more uniform spread is achieved. Spreaders come in heaped capacities of 5, 5⅝, and 6¼-cu yd, each powered by a 2-cylinder air-cooled gasoline engine rated 14.6 at 2600-rpm. **Fox River Tractor Co., CE-11, Appleton, Wis.**

Bridge Launcher

A NEW MILITARY FIELD aid, a mobile assault bridge launcher, was successfully demonstrated recently before the U. S. Corps of Engineers. It consists of heavy-duty automatic hydraulic system mounted on an M-48 tank chassis to handle an aluminum bridge of either 40-ft or 60-ft length. Controlled by the driver only, the hydraulic mechanism completely armor protected, carries the bridge, launches it, then detaches. The bridge, which can be retrieved by the tank from either end, consists of four sections and will support loads up to 60-tons and vehicles at the rates of 300 per hr. **Unit Rig & Equipment Co., CE-11, Tulsa, Okla.**

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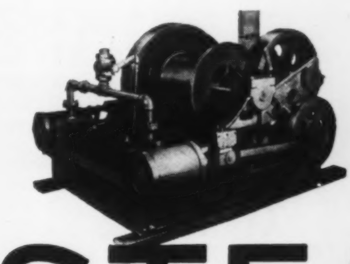

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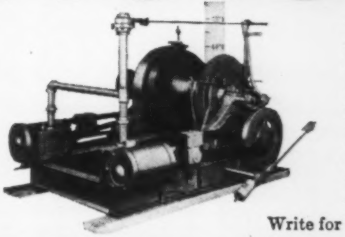

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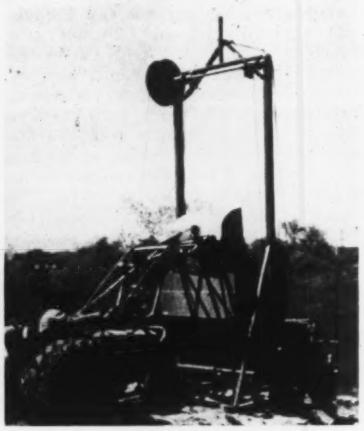
EQUIPMENT, MATERIALS and METHODS

(continued)

Trailer Batcher

A MIXER TRUCK AND a front end loader when combined with a new Trailer Batcher Model 300 will form a complete direct-charging plant, through which any aggregate or combination of aggregates may be batched at any time.

The batcher requires no fixed foundations or cable supports and there is no necessity for an electric current or other power. The hopper, when charged by the tractor loader, is elevated by a pull of approximately 100-ft on the elevating cable and discharges directly into the mix truck. The hopper can be charged from stock piles of any size. In the down position, it rests on scales which consist of a balance beam and 2 ingredient beams, one of 8000-lb and the other of 6000-lb. Every bearing of the undermounted scale lever system is pivoted and all bearings and pin stock are of heat treated tool steel. Another feature is an adjustable restraining spring indicator which allows the operator to anticipate the amount of aggregate required to achieve perfect balance. Extended push button control of all ingredient beam trip levers allows complete 1-man operation.



Model 300

As there are no belts, gears, sprockets, chains or engines to wear out, the Trailer Batcher is unusually durable. There are only 11 points of rotating wear and only 4 of these require periodic lubrication. **L. O. Funderburk, Jr. Mfg. Co., CE-11, Camden, S. C.**

Rotary Cutter

A ROTARY CUTTER, FEATURING a cutting width of 100-in., has been designed for use with all drawbar and power take-off equipped tractors of "3-plow" or greater power. It is suitable for such diversified tasks as shredding corn and cotton stalks, cutting down heavy brush, or maintaining parks and roadsides. Its width enables it to cover 3 normally spaced rows of crops at a time. Cutting height can be adjusted from 2-in. above ground to 11-in. by a linkage system which raises or lowers the 2 gauge wheels. Height can be adjusted by a remote-control hydraulic cylinder that is activated from the tractor seat or with a screw-type manual crank. The entire unit always remains parallel to the ground. Driven by the power take-off, the 4 free-swinging heat-treated blades are on 2 spindles with recessed hubs, and completely enclosed for protection. Integral deflectors spread the shredded cuttings uniformly over the full cutting width. A torque limiting clutch protects the drive train against overloading. All drives and belts are shielded as a protective measure. Only the wheels and power input shaft require lubrication. **Ford Motor Co., CE-11, Tractor & Implement Div., Birmingham, Mich.**

Mobile Maintenance Truck

CONVENIENCE AND ECONOMY have been achieved with a special mobile maintenance truck that services an entire fleet of earthmoving and paving machines. Nerve center is a receiver-mounted 36-cfm compressor, which has a 200-psi pressure rating and supplies the air that activates the system. It is mounted in a small space in the front left corner of the truck and is operated by a full torque power takeoff driven, through a special transfer case, by the truck engine.

Air from the compressor activates 2 high pressure grease pumps which supply track roll grease and chassis lubricant, a low-pressure pump which dispenses gear oil, and a transfer pump for motor oil. It also pressurizes four 50-gal tanks containing these fuels as well as water and hoist oil, which are supplied through spigots. These bottle type tanks are equipped with air regulators and safety valves in case of regulator failure and are mounted in a special frame between the reel and the compressor.

Five 40-ft hoses on reels across the back of the truck are used to supply most lubrication needs including oil for crankcases, grease for bearings and rollers and lubricant for gear boxes. Air for tires, gasoline and diesel fuel for engines are also dispensed through these feed linens. **Ingersoll Rand Co., CE-11, Phillipsburg, N. J.**

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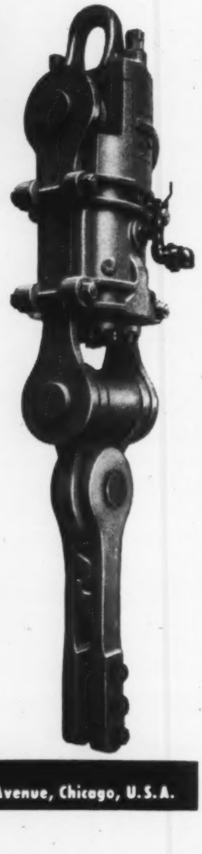

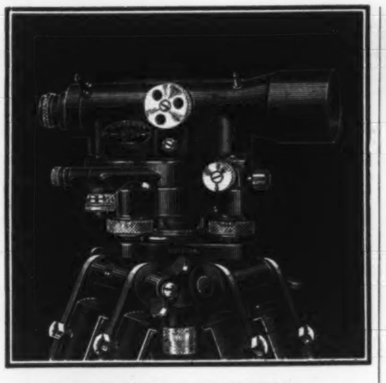

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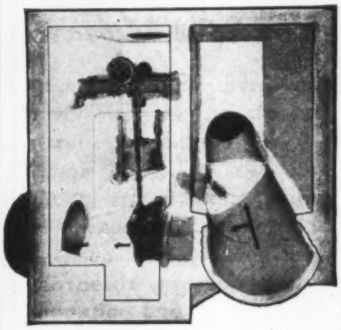

Fig. B-19

Automatic Sewage Regulators control sewage flows either by partially or completely cutting off such flows to suit head or tail water conditions or by "governing" to discharge a predetermined quantity regardless of head or tail water conditions.

Descriptive Bulletins and Engineering Data Available Upon Request

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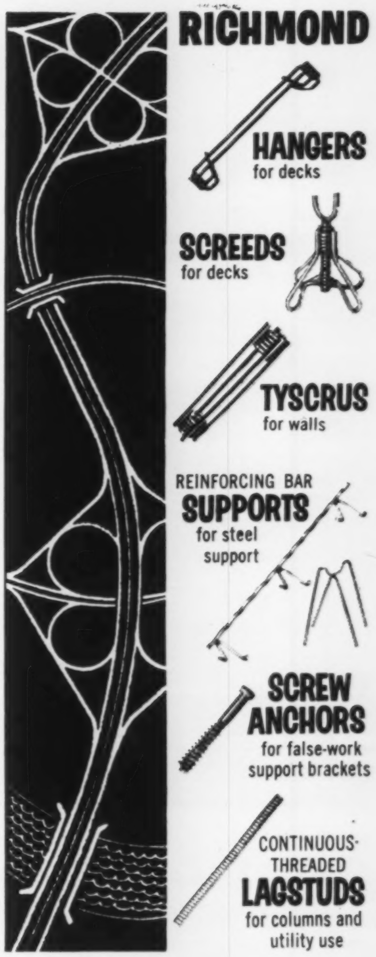
Literature Available

Water Control Gates—A 16-page technical Bulletin 163 outlines the several basic types of gates and their applications. Discharge curves are shown for preliminary sizing, and general specifications are included. Sectional drawings, standard dimensions and field photographs provide information on design characteristics and general construction. Also just published is Bulletin 158A which describes self-dumping trash rack rakes of the log-grapple and regular types. Self-dumping features, larger raking capacity and greater clear opening provide many advantages for pumping stations as well as steam and hydroelectric power plant water intakes. **S. Morgan Smith Company, CE-11, York, Pennsylvania.**

Rotation Rolls—How correct design can eliminate serious vibrations in rotating rolls by avoiding their critical speed is discussed in the report entitled "Roll Design Considering Critical Speed." Included is the mathematical formula for determining the first critical speed of a roll. (In most applications the second critical speed is never reached.) Also given are two examples showing how correct design can raise or lower the operating speed of a roll above or below its first critical speed to eliminate the possibility of serious vibrations. **Rodney Hunt Machine Co., CE-11, Orange, Massachusetts.**

Crawler Crane—A new 20-page illustrated catalog featuring the heavy duty, 1-yd 25-ton capacity crawler crane is now ready for distribution. It contains facts and photographs, describing economy and efficiency features in this convertible shovel, hoe, crane, clamshell, and dragline. Typical pictures include cut-a-way views of lower base assemblies, speed reducing units and tandem drums with booster-operated clutches, that illustrate the heavy-duty construction throughout. The new catalog gives complete pictoral information from crawlers to boompoint. Some typical "on-the-job" photos are included. **Bay City Shovels, Inc., CE-11, Bay City, Michigan.**

Platform Trailers—New literature giving a description and specifications of heavy duty platform trailers, has been released. The Model PX Platform Semi-Trailers are used extensively for on and off the highway hauling of concrete block, brick, lumber, steel, building materials, construction equipment and similar loads. Especially designed to meet load carrying requirements with maximum payload capacity, they feature full-length electrically welded wide-flange main beams and extra deep outer rail frame construction. **Transport Trailers, Inc., CE-11, 1200-34 Twelfth Street S. W., Cedar Rapids, Iowa.**



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From the MANUFACTURERS

REPORT WINS AWARD: For the seventh year, the annual report of Merritt-Chapman and Scott Corp. has been judged the best in the construction service industry by the independent board of judges for the international survey conducted by "Financial World," the national weekly magazine . . . **NEW DEPT:** Infilco Inc. announces a new department which will specialize in continuous, automatic cleaning of industrial liquids, primarily in the metalworking fields . . . **NAME CHANGE:** Machine and Tool Designing Company has announced a change in its corporate name to The M and T Company—Engineers, Designers and Consultants . . . **APPOINTMENTS:** Frank Ferren has been named regional sales manager of Galion Allsteel Body Company . . . Richard C. Locke has been appointed Supervisor of the General Construction Section, Development Div. of Caterpillar Tractor Co . . . **RECORD PILE SHIPMENT:** Five shipments totaling well over 4,000 Monotube fluted steel piles have been required by the National Economic Council of the Philippines for major dock and pier facilities at Manila. The order was received by the manufacturer, Union Metal Manufacturing Co., Canton, Ohio, earlier this year . . . **LADDERS:** The R. D. Werner Company has received word that its branded line of aluminum ladders and stages is now listed under the Label Service of the Underwriters' Laboratories Inc. This is the first time that any metal ladders have been so listed by UL . . . **NEW ACQUISITIONS:** Purchase of the extensive and important traffic signal and control business of General Electric Co., by Econolite Corp. of Los Angeles, for many years a leader in the west in the manufacture and distribution of this type equipment, was announced . . . The floating dredge business of the American Steel Dredge Division of the American Hoist and Derrick Co., Fort Wayne, Indiana, has been acquired by the Ellicott Machine Corp., Baltimore . . . **New PLANTS:** Construction of a new manufacturing plant at Danville, Illinois, for the Hyster Co., producers of one of the world's leading lines of industrial trucks, is progressing on a 53-acre site on the mainline of the Wabash Railroad . . . Construction has begun on a million-dollar engineering and research building program for Champion Spark Plug Co. Two new structures, having a total floor space of 35,000 sq ft, will be erected adjacent to the company's present Toledo, Ohio plant . . . A new 500,000 sq ft industrial engine plant located 12-mi north of Peoria, Illinois, has been begun by Caterpillar Tractor Co. The engine plant will be the first of three facilities built in the 1100-acre area, with a multi-building research center and a general offices building slated for future construction.

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PROCEEDINGS AVAILABLE

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October

1387. The Current National Picture in Urban Renewal, by Richard Steiner. (CP) This paper presents the national picture in urban renewal on September 30, 1956. It includes over-all facts and figures and touches on progress activities involving engineers. These undertakings include streets and highways, sewerage and drainage projects, flood control, schools, parks, and playgrounds.

1388. Planning Problems in the Washington Metropolitan Area of Virginia, by John E. Woodward, Jr. (CP) Coordinated planning by all communities involved is necessary for solution of problems resulting from the rapid expansion of the Washington metropolitan area of Virginia. The purpose of this paper is to review generally problems facing planners in this area.

1389. On the Dynamic Strength of Rigid-Plastic Beams Under Blast Loads, by Mario G. Salvadori and Paul Weidlinger. (EM) Upper bounds to the dynamic strength of simply supported beams acted upon by a uniformly distributed blast pressure are obtained under the assumption of rigid-plastic behavior in bending and/or in shear (development of "plastic hinges" and/or "plastic slides"). The results of the present analysis are valid for other types of impulsive forces.

1390. Demonstrations of Plastic Behavior of Steel Frames, by H. M. Nelson, D. T. Wright, and J. W. Dolphin. (EM) This paper presents results of full scale tests which were made to illustrate the behavior under load of structures designed by the plastic theory. Plastic analysis of moment redistribution was verified, and sheer, instability, and flange buckling effects were checked.

1391. Turbulence in Civil Engineering: An Introduction to Three Research Papers, by J. M. Robertson. (HY) The relation of the papers to the status of our knowledge and needs in turbulence is indicated through a review of ASCE publications, and a brief summary of the status of the turbulence problem.

1392. Turbulence in Civil Engineering: Measurements in Free Surface Streams, by Arthur T. Ippen and Fredric Raichlen. (HY) Various turbulence phenomena in free surface streams were investigated by means of a combination of a total head tube with a capacitance type pressure transducer. Design criteria for the instrument are given, as well as a series of performances data derived from turbulence measurements.

1393. Turbulence in Civil Engineering: Turbulence in a Diffuser Boundary Layer, by J. M. Robertson and G. L. Calehuff. (HY) Measurements of turbulence intensity and shear in the boundary layer on the inside of a 7½° conical diffuser are reported. Comparison of results with those reported for non-pressure gradient boundary layers indicates significant divergence from the universal inner region concept.

1394. Turbulence in Civil Engineering: Investigations in Liquid Shear Flow by Electromagnetic Induction, by L. M. Grossman, H. Li, and Hans A. Einstein. (HY) The relation of the papers to the status of our knowledge and needs in turbulence is indicated by a review of ASCE publications, and by a brief summary of the status of the turbulence problem.

1395. 100 Frequency Curves of North American Rivers, by E. Kuiper. (HY) This paper presents frequency curves of maximum annual flood flows on important rivers in North America. The frequency curves are drawn as straight lines. It was found that inclination of lines is a function of drainage area, climate, and soil conditions.

1396. Kemano Pressure Conduit Engineering Investigations, by F. L. Lawton and J. G. Sutherland. (PO) This paper considers some aspects of the basic investigations and tests associated with the design of pressure conduits for the world's largest underground hydroelectric generating station.

1397. Penstock Experience and Design Practice, by Gordon V. Richards. (PO) This paper reviews recent penstocks designed by a large west coast utility company and with this as a basis, presents in detail a summary of the company's current design procedures.

1398. Large Spiral Casings of T-1 Steel, by E. L. Seeland. (PO) Four of the largest turbine spiral casings, field welded, will be the first casings to date using T-1 steel, a low-carbon, quenched and tempered alloy plate steel with a high yield strength of 90,000 psi.

1399. Analysis of Continuous Beams by Fourier Series, by Seng-Lip Lee. (EM) This paper deals with analysis of continuous beams by means of expansion of arbitrary load function and intermediate redundant reactions in infinite trigonometric series. The values are determined by application of Castigliano's theorem, and the same procedure is used to derive expressions for influence lines for reactions.

1400. Nuclear Long-Range Fallout in Surface Waters, by Carlos G. Bell, Jr. (SA) Emphasis is placed on measurements for and calculation of runoff coefficients of gross long-range fallout beta radioactivity for several streams in eastern Massachusetts and the Genessee River in New York. Solubility of long-range fallout, its sedimentation, and its rate of dissipation after deposition is examined.

1401. The Hydraulic Design of Stilling Basins: Hydraulic Jumps on a Horizontal Apron (Basin I), by J. N. Bradley and A. J. Peterka. (HY) This paper presents a study of the hydraulic jump with reference to the applicability of the hydraulic jump formula, the length of jump over the entire practical range, and includes a new classification for the various forms of the hydraulic jump.

1402. Hydraulic Design of Stilling Basins: High Dams, Earth Dams, and Large Canal Structures, by J. N. Bradley and A. J. Peterka. (HY This paper analyzes the critical dimensions of thirty-six existing hydraulic jump stilling basins and hydraulic model verification tests which are used to generalize the design of a stilling basin utilizing chute blocks and an end sill.

1403. Hydraulic Design of Stilling Basins: Short Stilling Basins for Canal Structures, Small Outlet Works, and Small Spillways (Basin III), by J. N. Bradley and A. J. Peterka. (HY) This paper describes tests to generalize the design of a shorter stilling basin containing chute blocks, end sill, and one row of baffle piers. General design rules and sample problems are included. Critical basin dimensions, water surface profiles, and tail water ranges are presented in dimensionless forms.

1404. Hydraulic Design of Stilling Basins: Stilling Basin and Wave Suppressors for Canal Structures, Outlet Works, and Diversion Dams,

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by J. N. Bradley and A. J. Peterka. (HY) Where the Froude number of incoming flow is low, the hydraulic jump produces objectionable waves downstream. This study generalizes the design of two stilling basins and two types of wave suppressors for stabilizing water surface. Sample problems are used to illustrate design procedures recommended.

1405. Hydraulic Design of Stilling Basins: Stilling Basins with Sloping Apron (Basin V), by J. N. Bradley and A. J. Peterka. (HY) Procedures and rules for the design of a stilling basin with a sloping apron are presented, with a study of the relative merits of sloping and horizontal aprons. Critical basin dimensions and tail water requirements are presented in dimensionless forms. Recommendations are verified from an analysis of thirteen existing basins having sloping aprons.

1406. Hydraulic Design of Stilling Basins: Small Basins for Pipe or Open Channel Outlets—No Tail Water Required (Basin IV), by J. N. Bradley and A. J. Peterka. (HY) A consideration of an impact-type stilling basin developed which will handle 21 to 340 cu ft per sec. General design rules and a table listing critical dimensions and proper riprap sizes for nine different basin sizes are presented.

1407. Sanitary Engineering and Reactor Waste Disposal, by J. G. Terrill, Jr. and M. D. Hollis. (SA) The problem of nuclear reactor waste disposal offers a new challenge to the sanitary engineer. The general nature of reactor wastes, their effect on nature and treatment are discussed.

1408. Dispersal of Pollution by Tidal Movements, by T. M. Niles. (SA) The disposal of sewage into tidal waters has created many problems for the sanitary engineer. Chief among these is the calculation of total load which can be placed upon tidal waters. An approach to this problem is given, with data on the Potomac River and the Delaware River.

1409. Anaerobic Reduction of Manganese in Reservoirs, by John H. Weideman and Robert H. Fetner. (SA) Manganese may appear seasonally in some impoundments when part of the impoundment is anaerobic. One possible source of this manganese may be reduction of insoluble manganese dioxide found in the soil by carbon dioxide produced as an anaerobic by-product of biological metabolism.

1410. Niagara River Pollution, by Raymond W. Hess. (SA) The tremendous industrial development along the Niagara River created a pollution problem that has increased with time. Considerable study has been made into the pollutional problem and its solution. Progress is definitely being made to keep pollution to a minimum.

1411. Liquid Content of Garbage and Refuse, by John S. Wiley. (SA) The optimum moisture (water) content for aerobic composting of organic wastes varies considerably with the type of wastes. Determination of liquid content by a formula is proposed as an analysis more universally applicable than moisture content.

1412. Graphical Solution of Equations of Vibrations, by Wen-Hsiung Li. (EM) A graphical method is presented for analysis of dynamical systems of oscillations described by two simultaneous first-order ordinary differential equations. Examples of application are taken from hydraulic vibrations, including analysis of a differential surge-tank, and of a conduit with two surge-tanks.

1413. The Strength of Very Slender Beams, by E. F. Masur. (EM) The response of slender beams to lateral bending and torsion is analyzed. Large deformations lead to a nonlinear theory, whose strength predictions may deviate greatly from those of conventional linear analysis, especially with regard to redundant bending moments in the major plane of the beam. The theory is corroborated experimentally.

1414. Coexistence of Fish and Dams, by Howard A. Preston and Louis E. Rydell. (PO) This paper outlines the background of the Columbia River salmonoid fishery, the problems of sustaining it in the face of intensifying watershed development, and the need of continued progress toward improvement of the fishery in the light of the program for river development.

1415. Discussion of Proceedings Papers 1073, 1141, 1196. (EM) William Prager closure to 1073. Anatol Roshko on 1141. I. K. Silverman on 1196.

1416. Discussion of Proceedings Papers 948, 1086, 1216, 1285, 1344. (PO) R. T. Richards, E. T. Keck, J. Junget closure to 948. C. P. Lindner, L. F. Johnson closure to 1086. Benjamin Donsky on 1216. Richmond Pearson Hobson, Fritz Heidinger on 1285. Sylvester V. Williams, Fritz Heidinger on 1344.

1417. Discussion of Proceedings Papers 1077, 1114, 1197, 1198, 1199, 1200, 1201, 1202, 1260, 1266, 1277. (HY) Harald Tults closure to 1077. Francis F. Escoffier closure to 1114. Thomas Maddock, Jr. on 1197. E. F. Rice on 1198. T. E. Stelson on 1199. Leo R. Beard, Manuel A. Benson on 1200. Leslie J. Hooper, B. L. VanderBoegh on 1201. E. M. Laursen and A. Toch on 1202. A. Rylands Thomas on 1260. E. A. Elevatorski on 1266. Lloyd C. Fowler and Robert H. Livesey on 1277.

1418. Inelastic Analysis of Eccentrically Loaded Columns, by M. E. Clark, O. M. Sidebottom, and R. W. Shreeves. (EM) This paper presents a theory by which the collapse load of an eccentrically loaded column can be rationally determined. Experimental verification of the theory was obtained from tests made on aluminum alloy rectangular and T-section columns. A study of the effect of time on the magnitude of the collapse load was also made, using SAE 1020 steel columns.

1419. Sir Adam Beck-Niagara Generating Station No. 2, by Frank Dobson. (PO) This paper presents design and construction features of an extension to a hydroelectric power generating station on the Niagara River and its associated works, with particular emphasis on the pump-storage-generating plan used to preserve the scenic spectacle of Niagara Falls.

1420. Fixed-Wheel Gates for Penstock Intakes, by Sylvan J. Skinner. (PO) There is a dearth of published information on actual overall design of high-head flat structural steel fixed-wheel gates used for emergency closure of penstock or other conduit intakes. This paper covers the major design problems and present design treatment by the Bureau of Reclamation, U. S. Department of the Interior, for this type of gate.

1421. The Regulation Chart for Power Computations, by C. P. Lindner. (PO) A rapid method is explained for computing power output and prime flow of a system of reservoirs and power plants. Adjustment of power output and prime flow for leakage and evaporation losses is described, and formulas for economic installation for secondary power are given.

1422. Discussion of Proceedings Papers 928, 1083, 1224. (SA) K. Fraschina on 928. D. E. Bloodgood, W. J. Boegly, and C. E. Smith closure to 1083. Harold E. Babbitt on 1224.

1423. Settling Behavior of Waste Suspensions, by Vaughn C. Behn. (SA) The qualitative mechanism of a settling slurry is set forth with consideration given to experimental equipment used to observe such behavior. The means by which data from such equipment has been analyzed quantitatively is delineated. The application to a sewage sludge is demonstrated.

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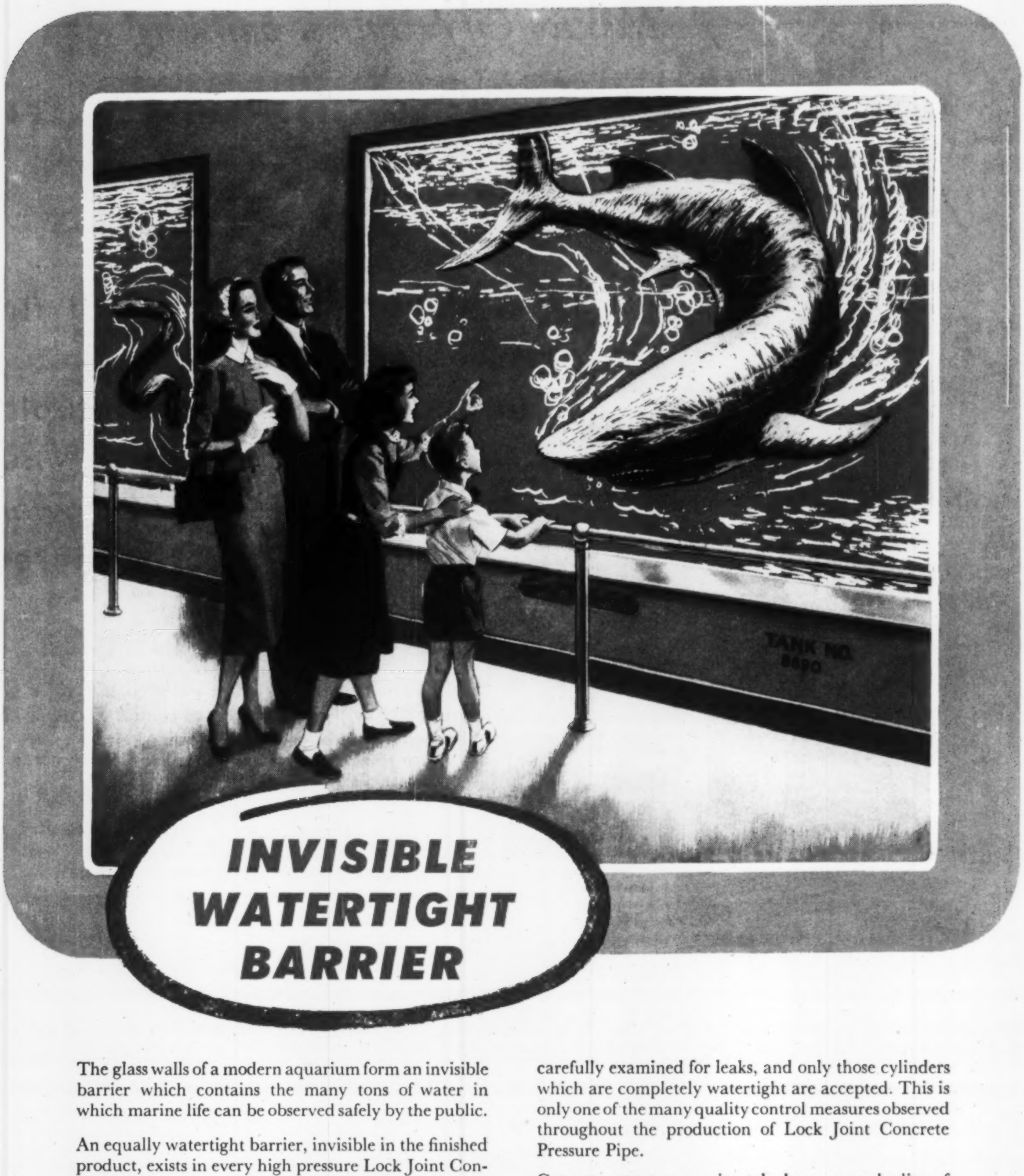

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